AN EMPIRICAL INVESTIGATION OF THE EFFECTIVENESS OF THE LOGISTICS READINESS SQUADRON CONCEPT

GRADUATE RESEARCH PAPER

Christopher L. Carmichael, Major, USAF

AFIT/IMO/ENS/12-04

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/IMO/ENS/12-04

AN EMPIRICAL INVESTIGATION OF THE EFFECTIVENESS OF THE LOGISTICS READINESS SQUADRON CONCEPT

GRADUATE RESEARCH PAPER

Presented to the Faculty

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics

Christopher L. Carmichael, MHR

Major, USAF

June 2012

AFIT/IMO/ENS/12-04

AN EMPIRICAL INVESTIGATION OF THE EFFECTIVENESS OF THE LOGISTICS READINESS SQUADRON CONCEPT

Christopher L. Carmichael, MHR
Major, USAF

Approved:

//SIGNED//	30 May 2012
Doral E. Sandlin, Lt Col, Ph.D	Date

Abstract

The research in this paper attempts to determine the effectiveness of the Logistics Readiness Squadron (LRS) and its effect on Air Force aircraft availability. It examines Unit Compliance Inspections (UCI) results and Not Mission Capable for Supply (NMCS) rates gathered from 1998 till 2011. The data generates an overall trend and a trend before and after the implementation of the LRS. The results are analyzed to determine any positive, negative, or neutral trend. There are many factors that determine LRS effectiveness and have impact on aircraft availability. Based on the analysis of the data used for this research, the effectiveness of the LRS is inconclusive. Based on this study and in comparison to the supply squadron, transportation squadron, and logistics plans section of the pre Chief-of-Staff Logistics Review (CLR) era, the LRS is neither a negative nor positive evolution for Air Force logistics. Given time to mature in an era with a lower LRO deployment rates the LRS has the potential to demonstrate a positive inspection rate trend and provide benefit for the Air Force.

Acknowledgments

Thanks to my wife and my children for all their love and support and ensuring there was time to complete this project. Thanks to my classmates for all their guidance and motivation. Thanks to the staff of the USAF EC, especially Mary Traver and Pamela Bardot, for keeping me on track and providing much needed research assistance. Finally, a special thanks to my advisors and sponsors, Maj Chris Randall, Lt Col Chris Holmes, and Lt Col Ned Sandlin, who volunteered much of their time to this project allowing for a comprehensive product.

Christopher L. Carmichael

Table of Contents

List of Figures

List of Tables

List of Equations

AN EMPIRICAL INVESTIGATION OF THE EFFECTIVENESS OF THE LOGISTICS READINESS SQUADRON CONCEPT

I. Introduction

General Issue

In recent years Air Force logistics leaders have expressed concerns with regard to the effectiveness of the Logistics Readiness Squadron (LRS) and the Logistics Readiness Officer (LRO). Specifically, a slideshow created by the U.S. Pacific Air Force's Logistics Directorate (PACAF A4), titled "LRO/LRS in Crisis" was circulated presenting issues such as Unit Compliance Inspection failures as well as perceived issues such as LRO lack of confidence with their non-deployed responsibilities and LROs are "neither leading nor learning" (HQ PACAF). There are many factors that could lead to such perceptions; however, this research will focus on the performance of the LRS. As of May of 2012 no known quantitative study on the effectiveness of the LRS has been conducted.

Background

In 2003 the Air Force implemented a new logistics strategy. This strategy resulted from the Chief of Staff Logistics Review (CLR), directed by General Michael Ryan, then the Chief of Staff of the Air Force, in October 1999 (Lynch, 2005:iii). Prior to 2003 the Air Force logistics structure went through much iteration. The organizational structure of Air Force logistics immediately prior to the CLR was a result of the General Merrill McPeak era Objective Wing structure and was separated into four parts; aircraft maintenance, transportation, supply, and logistics plans. While under this structure the

Air Force was suffering a decline in aircraft mission capable rates (aircraft availability). The mission capable rates declined from 84 percent in 1994 to an Air Force mean of 71 percent by 1999 (Lewis, 2009:12). This resulted in the CLR which resulted in a new concept called the Combat Wing Organization, in 2003.

This change was intended to consolidate all Wing level aircraft maintenance under one maintenance commander, the Maintenance Group Commander. This change had a positive impact on mission capable rates, Air Combat Command and Air Mobility Command rates averaging 78.8% over CY 2003-2011 (LIMS-EV), however no study was conducted to determine the LRS impact on mission capable rates. The restructuring of maintenance was not a new concept in Air Force history. However, removing maintenance from under operations control was only one objective of the Combat Wing Organization, the other was the integration of the remaining core logistics functions into the LRS. This squadron is a combination of the supply squadron, the transportation squadron, and the logistics plans section into one organization.

Air Force logistics functions have evolved extensively over the past several decades. The days when the Air Force supply system was required to purchase, store, and distribute day to day supplies such as pens, pencils, and paper towels are a thing of the past. Additionally, over the years Air Force surface transportation has also reduced in size and scope. Base level vehicle fleets are now predominantly leased and maintained through a civilian contracted organization. This reduced focus has allowed Air Force logistics leaders to focus more directly on aircraft related issues, specifically, aircraft parts and their relation to Mission Capable (MC) rates. The current supply and transportation structure of the Air Force is centered on the procurement and distribution

of aircraft parts and is largely based on a just-in-time delivery system. Because of direct and express delivery, large bench stock systems requiring large warehousing for many different types of aircraft parts are long gone. The procurement of aircraft parts has been centralized into an enterprise-wide system maximizing the effectiveness of the procurement and distribution system. Plus the majority of the distribution of aircraft parts is managed through commercial carriers and not the Air Force transportation system. These radical changes, together with the current reduced size of the Air Force and its aircraft fleet, led to sizable reductions in the mission, size, and role of the Supply and Transportation Squadrons, causing a reexamination of the Air Force logistics system. The reduced size and span of leadership required less oversight making it possible to reduce redundancies at the squadron level. Together with the CLR's charge, to search for areas that require process improvement, led to the creation of the LRS (Lynch, 2005:xviii-xxi). The reduction of scope allows the LRS commander to become the single process manager for the distribution of aircraft parts. Therefore a single logistics supply chain manager would have a greater impact on aircraft availability.

In an effort to increase the aircraft availability rates there are specific processes under supply and transportation that can be improved. These processes revolve around the procurement of aircraft parts and the movement of these parts from origin to aircraft. This is partially captured in the NMCS rate. The NMCS rate is the percentage of time an aircraft is not mission capable due to a maintenance work stoppage because a lack of aircraft parts (Chimka and Nachtmann, undated: 45). At the wing level the LRS has the most influence on the storage, stockage and distribution of these parts. There was overlap with the movement of these parts between the supply and the transportation

functions and most of that overlap was consolidated in to a process (section) called "pick-up and delivery" which was a transportation section and supply section merger prior to the 2003 creation of the LRS. The goal for the LRS is to increase the efficiency of the part storage, stockage, and delivery process, versus bench stocking and stockage effectiveness, effectively decreasing NMCS rates. Examining the NMCS rates before and after the 2003 CLR will show the impact the LRS has had on the Air Force logistics process. Additionally, LRS inspection results from before and after the 2003 CLR can be examined to determine how effective the LRS concept has been on the Air Force logistics process. While there have been qualitative studies conducted regarding the LRS and the LRO no quantitative study has been conducted to evaluate the performance using NMCS or inspection results accumulated since the creation of the LRS.

Problem Statement

Since the completion of the CLR the intended and unintended impacts of the logistics restructuring are not well understood. There has never been a qualitative or quantitative study using the eight years of available inspection and NMCS data to determine if the LRS concept is an effective improvement on Air Force transportation, supply, and logistics plans processes. This subject is important to research because logistics is a critical part of the Air Force's mission. If a negative trend exists in the LRS which may be causing a lack of performance, the mission of the Air Force is directly impacted. This is important to all airmen and leadership should determine if the LRS is focused in the correct direction. If the LRS is failing as a concept and is contributing to a decrease or not improving the Air Force aircraft availability process, leadership should

determine what requirements are needed to better support the Air Force's customer. Now is the time to study this topic. Prior to now, no long term inspection and NMCS data existed to study the LRS' effectiveness.

Research Focus

The primary focus of this research is the Air Force LRS. The research is narrowed to logistics squadrons under Air Combat Command (ACC), Pacific Air Force's Command (PACAF), and U.S. Air Forces Europe (USAFE). This research is focused on UCI results and NMCS rates for all three Major Commands separately as well as combined.

Research Objectives

The researcher will examine how effective the LRS has been since the implementation of the Combat Wing Organization. Inspection results and not mission capable for supply (NMCS) rates will be used to determine squadron effectiveness. The data collected from inspection results and the NMCS rates will serve as indicators the effectiveness of the LRS concept and what impact the restructuring of core logistics functions has had on key performance measures. The purpose of the research is to determine whether or not restructuring of core logistics functions improved Air Force logistics processes and whether it has positively impacted the Air Force's aircraft availability rates.

Investigative Questions

- Historically, how has the effectiveness of logistics functions been measured (Supply, Transportation, and Logistics Readiness Squadrons)?
- What is the trend with Supply Squadron, Transportation Squadron, and Logistics Plans section inspection results compared to the trend with LRS inspection results?
- What is the trend with specific logistics processes (supply, transportation, and logistics plans) based on inspection results before the implementation of the LRS and after the implementation of the LRS?
- What is the trend with the NMCS rates before the implementation of the LRS and after the implementation of the LRS to determine the effect of the LRS?

These investigative questions will determine if there are trends within the inspection results of the LRS. They will determine if there are trends within specific logistics processes that are examined during the inspections. Additionally, the investigative questions will determine if there are any trends within the NMCS rates. All trends will be compared before the implementation of the LRS and after the LRS to see the effect the new squadron structure has had on logistics processes. An assessment will be made to determine how effective the LRS has been on the NMCS rate and therefore the Air Force aircraft availability rate.

Methodology

Each investigative question will use a quantitative analysis of the inspection data and the NMCS rate data collected. The data were collected from Air Combat Command

(ACC), United States Air Forces Europe Command (USAFE), and Pacific Air Forces Command (PACAF). As much data as was available was collected to ensure a fair comparison before the implantation of the LRS and after the implantation of the LRS. For example, inspection results were collected for ACC as far back as 1998 and as current as 2011. This provides a pre-LRS baseline of five years and a post-LRS analysis of eight years. The inspection results research was limited to ACC, USAFE, and PACAF.

LRS unit compliance inspection (UCI) results were obtained from ACC, PACAF, and USAFE for years 1998 through 2011. The data capture a perspective from multiple theaters. This ensured a fair and accurate sample that is representative of a broad Air Force LRS structure. Also, the sample size should be large enough to provide an accurate representation of the population. ACC, PACAF, and USAFE have a total of 43% (32 of 74) of all the Logistics Squadrons in the Air Force according to, data provide by Headquarters Air Force, Logistics Directorate. Below is a breakdown of the sample sizes for UCI by major command:

Table 1: Pre/Post-LRS Unit Compliance Inspections

UCIs	Pre-LRS	Post-LRS	Total
ACC	17	20	37
PACAF	8	8	16
USAFE	6	21	27
Total UCIs	31	49	80

With this data a comparison from before the implementation of the LRS and after the implementation of the LRS can be accomplished. This data was collected from the

Inspector General's office from each MAJCOM. The overall rating results were analyzed using the historical mean inspection rate to determine if a trend is apparent.

All inspection data was compiled by four major categories, transportation, supply, logistics plans, and all three combined. A detailed analysis of major categories was conducted to determine all trends associated by specific logistics function.

In addition to the inspection results, an analysis of the NMCS rates for the aircraft in ACC, PACAF, and USAFE was completed. This analysis will determine any trend in the NMCS rate and the effect the LRS has had on the rate, inferring the LRS's impact on aircraft availability.

Assumptions/Limitations

It is assumed that the NMCS rate best reflects the LRS's direct impact on the Wing's aircraft availability. It is assumed that inspection results are, in part, a reflection of how well logistics functions are being performed in the Air Force and how well the squadron is performing at its logistics mission. It also makes an inference on how well the leadership of the squadron is performing. Additionally, UCI criteria for each major command inspect the same areas with the same or very similar inspection items. Therefore, it is assumed the inspection results can be compared side-by-side to determine the effectiveness of the LRS concept.

Over time, inspection checklists are adjusted to reflect new processes and procedures. Great effort was made when comparing inspected items, ensuring an accurate comparison as inspection checklists changed over the years. Additionally, some reports did not include or inspect all areas of the logistics squadrons. Therefore, it is

assumed that all inspection reports contain enough inspected items to give an accurate reflection of the logistics squadron at the time of inspection. Some major command's have a small number of inspection reports on any particular year. It is assumed that these years with reduced inspection reports reflect accurately on the entire command for that particular year.

Implications

This study is among the first to quantitatively assess the impact of the LRS structure on key Air Force performance measures. It will provide important insights for senior Air Force leaders as decisions are made about how best to organize and structure the logistics network. This research has the ability to shed light on the validity of the LRS concept through analysis of key LRS performance outcomes. This research will help to determine the impact the LRS has on factors related to aircraft availability.

II. Literature Review

Chapter Overview

In this chapter, the relevant literature related to establishment and further examination of the LRS will be reviewed. The researcher identified eleven related studies or research papers on the subject of the LRS or the LRO. All but two are graduate research papers sponsored by the Air Force Institute of Technology, the Air War College, Air University, or The US Army Command and General Staff College. One is a study conducted by the Air Force and the RAND Corporation and the other an article in the Air Force Journal of Logistics. One study continues by addressing the LRS concept, specifically how the logistics concept of the Air Force has evolved and the course of action for the future of Air Force logistics (Lewis, 2009:6). The Air Force study conducted with RAND however is the Air Force Chief of Staff Logistics Review (CLR) and the catalyst for all the remaining research papers or articles that followed. It is also the basis for this research paper.

None of the research reviewed to date includes a quantitative analysis of inspection results or NMCS rates. Most if not all the research conducted so far involves qualitative research used to determine the effectiveness of the LRO and or the LRS. A good portion of the literature reviewed consists of expert opinion and not quantitative data analysis.

Historical Background

Historically, the goal of any restructuring of an organization is to increase profitability, increase productivity, and or increase efficiencies. Structure refers to the

relationships between internal components of an organization (Thompson, 1967). Structure is required to maximize effectiveness and efficiency (e.g. maintenance decentralized to increase effectiveness and the creation of the LRS was designed to increase efficiency). When supply and transportation were interdependent organizations it required more concerted effort to achieve coordination. The consolidation of the Pick-up and Delivery section in 2000 is an example of that complicated coordination effort. It combined functions from the Transportation Squadron and the Supply Squadron streamlining the acceptance and delivery of aircraft parts using assets and personnel from both squadrons. The change to the LRS structure allowed for a minimal coordination cost and a more flexible environment allowing for efficiency (Thompson, 1967). Prior to 2003 the Air Force's logistics structure was separated into functional components, Supply, Transportation, Logistics Plans, and Maintenance. Flightline level maintenance was controlled and managed by the Operations Group under the Objective Wing structure put in place by General Merrill McPeak in the early 1990s. As a result of declining mission capable (aircraft availability) rates from the early 1990s to 1999 General John P. Jumper, then commander, United States Air Forces Europe presented a briefing entitled, "Posturing Aircraft Maintenance for Combat Readiness" to the then United States Air Force Chief of Staff, General Michael E. Ryan. His presentation outlined the need for structural change in the aircraft maintenance arena. However General Ryan wanted to explore any possibility of process improvement prior to logistics structural changes. This was the catalyst for the implementation of the CLR. As a result, the CLR realigned maintenance under a maintenance commander versus an operations commander. Over the years the control over flightline maintenance has shifted back and forth between

operator and maintainer, as shown in Table 2 (Lynch, 2005:147-172). It is simply a question of balance between the need for maintenance and the need to fly the aircraft.

Table 2: United States Military Aircraft Maintenance History (Lynch, 2005:147-172)

Era	Structure	Notes
World War I (early 1900s)	Decentralized	Depot level maintenance was established
World War II	Centralized	Army Air Corps established, echelon maintenance established
Post-WWII	Decentralized	Strong centralized control under a Wing Maintenance Control
Hobson Plan (Post 1947)	Decentralized	U. S. Air Force established, Hobson Plan – Combat Group (org maintenance), Maintenance and Supply Group (field level maintenance), Air Base Group, and Medical Group
Berlin Airlift	Centralized	Centralized control of all maintenance for the purpose of the Berlin Airlift
1950s	Centralized and Decentralized	MAJCOM specific structures, most decentralized till 1953. An Air Staff study conducted in 1955 concluded that all maintenance will be centralized under the control of the wing chief of maintenance
AFM 66-1	Centralized	All maintenance under the wing chief of maintenance who reports directly to the wing commander
Vietnam Conflict	Decentralized	Deployed unit maintenance and maintenance officer were under the control of the operator. After General LeMay's retirement as Air Force Chief of Staff the fighter community operators took control over flightline level maintenance for tactical fighter aircraft
Downsizing (early 1970s)	Centralized	Reduced manpower and low reliable weapons systems caused the need for centralized control over maintenance. AFM 66-1 established maintenance as the priority over the flying schedule
POMO (Mid-1970s)	Decentralized Execution with Central Control	Production Oriented Maintenance Organization (POMO), repair, servicing, and launching maintainers in flightline organization, the rest in back shops; still

		centralized control with chief of maintenance
Late 1970s and 1980s	Increased Decentralized Execution, Less Centralized Control	Supply decentralized, maintainers now coordinated maintenance and did not control maintenance
Early 1990s	Decentralized and Centralized	MAJCOM specific; TAC and SAC decentralized, MAC consistently centralized
Objective Wing (Mid to late 1990s)	Decentralized	Flightline maintenance with the operator, back shop maintenance with the maintainer
Chief of Staff Logistics Review	Centralized	
Decentralized = Maintenance Controlled by the Operator Centralized = Maintenance Controlled by the Maintainer		

There is little doubt that the CLR realignment of the maintenance structure was a success. The CLR survey data concluded, as shown in Table 3, that once maintenance is placed back under the control of a maintainer, not an operator, the Air Force achieved a better balance of required maintenance versus the need to operate the aircraft (Lynch, 2005:30).

Table 3: Overall Acceptance of CLR Realignments (Lynch, 2005:29)

Overall Acceptance of CLR Realignments

	Maintainers			
ALL—MAF/CAF[a] (198)	Total (167)	In OG (46)	In LG (121)	**Operators (31)**
Favorable	72%	48%	82%	58%
Unchanged	14%	24%	10%	29%
Unfavorable	13%	26%	8%	13%
Don't Know/No Opinion	0.6%	2%	0%	0%

NOTES: Appendix F provides more SP/FH quantitative data gathered during the site visits.
[a] Mobility Air Force/Combat Air Force.

It was said by Brig Gen Gabreski, USAFE, Director of Logistics (USAFE/A4) and Air Staff Director of Maintenance (AF/ILM), "Once this fundamental issue (of what it takes to achieve balance) is understood and mechanisms are put in place to achieve that balance, any form of support organization can be made to work, although some may be

more efficient than others, and some may be more effective than others" (Lynch, 2005:94). However, to keep things in perspective, some argue the Air Force should not immediately consider restructuring its organization every time a problem presents itself. Restructuring is not necessarily the solution to the problem (Lewis, 2009:9). As shown in Table 2 the United States military restructured aircraft maintenance at least fourteen times. The responsibility of flightline maintenance has shifted between the operator and the maintainer multiple times. Based on the CLR, flightline maintenance has been placed under the control of the maintainer, however, the CLR was not totally clear on whether or not that was the correct decision based on historical evidence. The CLR based its recommendations on personal opinion and survey data, not hard data such as MC Rate. However, it was clear based on the desires of the officers interviewed for the CLR that centralized control was the correct decision to make.

Relevant Research

The impetus for the 2003 Air Force logistics re-engineering and the creation of the LRS was the CLR and its associated RAND Corporation study. The RAND study set the following guidelines for its review:

- Evaluate processes rather than organizations
- Examine centralized versus decentralized execution for home/deployed forces
- Gather insights from both logisticians and operators
- Develop changes/adjustments within constrained funding boundaries
- Develop metrics to compare solution options against the AEF operational goals
- Identify accompanying benefits, costs, and risk

As a result of the MAJCOM inputs and the RAND analysis, the wing-level distribution process was streamlined. This led to the combination of the supply and transportation functions reducing redundancies and providing a single base level supply chain leader for aircraft parts. This led to the creation of the LRS (Lynch, 2005:xviii).

The RAND Study conducted a six month test of the new logistics system from September 2001 till March 2002. As a result of the test, the following material management and contingency planning issues were presented for consideration (Lynch, 2005:xxi):

- "Consider revisiting the LRS restructure from the view point of maintaining the integrity of the distribution process as it is defined and conceptualized by Air Force theater distribution needs"

- "Consider creating new metrics that focus on the distribution process with related segments and, in turn, show how the base-level distribution process fits into the larger global/theater distribution process"

The Air Force has addressed the issue of maintaining the integrity of the distribution process and the creation of new metrics to determine how the base-level distribution process fits into the global process. This was addressed with the creation of the Global Logistics Support Center and the global enterprise view of part parts procurement and distribution.

As directed, the CLR study should evaluate processes rather than organizations. The RAND study responded to specific process problem areas, with regard to the LRS

the problem areas were material management and contingency planning. The CLR defined materiel management as "the supply and transportation functions inherent to the receiving, shipping, movement, storage, and control of property" (Lynch, 2005:53). Using inputs from each MAJCOM the study concluded that there were very little process deficiencies and just as little suggestions for process improvements. As a result of MAJCOM inputs and the RAND study, some of the final solution options considered by Air Force leadership included improving the regional supply squadron policy and the creation of a single authority for distribution processing. The MAJCOMs considered the merger of the Supply and Transportation Squadrons into one LRS as a favorable option. The RAND study concluded that combining the supply and transportation functions into the LRS could improve customer support, responsiveness, and reliability while reducing process cycle time with regard to aircraft parts. The study concluded that 24 percent of the wing/group leaders and squadron personnel interviewed viewed the merger had a positive impact on base level distribution, 7 percent saw a negative impact, and 69 percent had no opinion or felt it had no impact (Lynch, 2005:56). The RAND study concluded that almost everyone understood the benefit of organizing the unit structure around the core process (Lynch, 2005:58). Under a single base level supply chain manager, the LRS has the potential to improve the NMCS parts rate and improve the time it takes for aircraft maintenance to receive replacement aircraft parts. The NMCS rate has been the primary indicator to determine how well the supply and distribution process has supported aircraft availability.

The LRS concept has allowed for the reduction of redundancies between the supply and transportations squadrons which opened the door for process improvement.

Additionally, the Air Force has leveraged the improvements as well as technologies to streamline and consolidate efforts, for example the creation of Global Logistics Support Center (GLSC). GLSC manages the procurement and distribution of aircraft parts, capitalizing on the global enterprise view, consolidating effort, and thus liberating this task from the wing level and the LRS (Lewis, 2009:15, 17).

There is still debate however over where the LRS should be located, under the Mission Support Group (MSG) or under the Maintenance Group (MXG). Proponents of the MSG argue that maintenance should be left separate enabling maintainers to focus on the "fix" tenant, thus improving aircraft availability (Lewis, 2009:17). Since the LRS is responsible for many other functions that fall outside the "fix" tenant placing the LRS under the MSG ensures the maintainer is not responsible for anything outside this tenant. Prior to 2003 when supply, transportation, and maintenance all fell under the Logistics Group (LG) a great deal of time and energy was spend by the LG commander on aircraft parts procurement and distribution which are key and essential to aircraft maintenance. If an LG or MXG commander has control over the procurement and distribution of aircraft parts there is a stronger likelihood of reducing aircraft downtime and thus increasing aircraft availability (Dyess, 2003:44).

Evaluation of Logistics

The NMCS rate is calculated using the formula outlined in Equation 1 below (Pendley, 2008:77):

Equation 1: Formula for NMCS Rate

$$TNMCS\ (\%) = \frac{NMCS\ Hrs + NMCB\ Hours}{Possessed\ Hours} \times 100\%$$

It is generally accepted that the primary input the LRS has to the MC rate is the NMCS rate. While it was noted, the maintenance enterprise has a direct impact on NMCS as well. For example, maintenance can keep a lower NMCS rate by consolidating cannibalization to as few aircraft as possible (Pendley, 2008:76). The LRS's direct link into aircraft availability is the NMCS rate. The LRS is the base level leadership's direct link into aircraft parts procurement and distribution. The LRS has impact on the parts procurement to satisfy maintenance parts needs.

The Air Force's inspection process is an initiative to ensure all units maintain a standard of readiness and compliance. The UCI in particular is designed to evaluate the level of compliance as prescribed by each major command. The LRS functions are evaluated similarly across all major commands ensuring compliance in the major areas of supply, transportation, and logistics plans (AFPD 90-2, 2006:2).

Assessing the Validity of the Research Method

The research method is to analyze historical quantitative data to determine the effectiveness of the LRS and its impact on aircraft availability. Before the LRS and its processes can be evaluated, the effectiveness measurements of supply, transportation, and logistics readiness must first be examined. This is accomplished using the first investigative question).

- Historically, how has the effectiveness of logistics functions been measured (Supply, Transportation, and Logistics Readiness Squadrons)?

Based on the research gathered for this paper LRS effectiveness is determined by how well it complies with required standards supporting mission requirements as outlined by each major command (i.e. UCI results), as well as how well the LRS supports Air Force aircraft availability (AFPD 90-2, 2006:2). The LRS's direct link into aircraft availability is the NMCS rate. While many factors outside the LRS have impact on the NMCS rate (e.g. GLSC, commercial carriers, maintenance practices, etc.), the LRS is the base level leadership's direct link into aircraft parts procurement and distribution. For example, the LRS has the ability to influence delivery method for mission critical parts. The LRS also has influence over aircraft parts trend analysis. If they recognize a wing level trend, the LRS has direct impact on the parts procurement to quickly satisfy any need. Both the NMCS and the UCI results can be compared directly with MC rates to determine the effectiveness of an LRS. Therefore the research method chosen for this paper provides the most accurate method to assess the LRS and how it has impacted aircraft availability. The research method will determine if the LRS has satisfied the intent of the CLR.

Summary of Research

As a result of the RAND six month test of the new logistics system a survey was completed to determine the effectiveness of the test. The survey included interviews from wing and group leadership as well as interviewees from the supply, transportation, and logistics plans disciplines. It was concluded that most of the interviewees showed a clear bias toward the new structure and expressed with good leadership the personnel and system will adapt accordingly to the new LRS structure (Lynch, 2005:59). The CLR used personal opinion data analysis to draw its conclusions. This study differs from the

RAND study in a few ways. It uses a quantitative analysis of NMCS and UCI data versus a quantitative analysis of opinion based survey data. The RAND study was conducted shortly after the initiation of the LRS in contrast this study used data collected before the creation of the LRS and eight years after the creation of the LRS. After the eight year maturing of the LRS, the NMCS and UCI data has no bias where the RAND survey data was based on the opinions of airmen just after the creation of the LRS.

III. Methodology

Chapter Overview

In this study, a trend analysis of mean UCI inspection results and the mean NMCS rates is adopted to investigate the effectiveness of the LRS concept. A t-test analysis of the data could not be accomplished due to the small sample sizes of the data collected. The research of this paper is an empirical analysis of historical quantitative data to determine the effectiveness of the LRS and its impact on aircraft availability. First, a quantitative trend analysis is performed which compared logistics UCI results is conducted from before the implementation of the LRS and after the implementation of the LRS. Second, a trend analysis of the NMCS rates, for all aircraft, is conducted from before the implementation of the LRS and after the implementation of the LRS to determine the LRS's impact. Both inspection data and NMCS data are used to determine the LRS's impact on aircraft availability. This chapter will discuss how and what data was used, it will break down the strategy for data analysis, it will discuss how the trend analysis will be used to determine the effectiveness of the LRS concept, and it will assess the validity of the trend analysis research method.

Data Collection

The UCI results used for this research were obtained from the Inspector General of ACC, USAFE, and PACAF. They are comprised of inspections for all wing organizations (excluding Air Guard and Reserve units) between the years 1998 and 2011. Results for ACC were included from all years except 2001 and 2007. There were no inspections reported by ACC in 2001. The inspection results for the year 2007 were

excluded because they only encompassed one inspected wing and only in the area of supply. No other wing or logistics area was inspected that year. This lack of data for ACC in 2007 created an outlier that greatly impacted the overall trend. Therefore, the single inspection for ACC in 2007 was eliminated from that data pull for ACC. However, that inspection result was included when comparing all three major command's inspection data because there were 3 total inspections for the year 2007. The inspection results for USAFE start in 2000 and ending in 2011 and all inspections are thorough enough for analysis. The inspection results for PACAF start in the year 1998 and end in 2011. However, there are no PACAF inspections reported in the years 1999 and 2001. UCI data collected yielded a sample size of 80 UCI reports as show in Table 1.

All inspection reports (N = 80) except 9 inspect all areas of logistics (supply, transportation, and logistics plans). Those 9 limit their inspections to one or two areas. Supply or transportation is inspected in 8 of those 9 inspections, leaving one inspection in ACC in 1998 which inspected logistics plans only. Not all inspection items were evaluated in every area (supply, transportation, or logistics plans) for each inspection. For most reports a majority of inspection items were evaluated. Over the 137 inspections collected enough data was acquired to establish an overall trend, a trend by major command, and a trend before and after the implementation of the LRS.

The NMCS and MC rates were collected from the Air Force's Logistics Installations and Mission Support – Enterprise View (LIMS-EV) system. Through LIMS-EV, data were collected for NMCS and MC rates by major command, by year, over the period 1998 - 2011. Both rates were filtered to exclude Air Guard and Reserve

aircraft statistics. The data includes all theaters of operation for each major command as well as all active duty aircraft and all aircraft block models.

Data Analysis Strategy

All inspections were downloaded from scanned documents and transferred to a spreadsheet for analysis. A common method for interpreting the data was required for the spreadsheet analysis. The inspection criteria established for ACC and part of USAFE's inspection results were given a rating of Complies, Complies with Comments, or Does Not Comply. However, inspected items for PACAF and most of USAFE were given a rating of Outstanding, Excellent, Satisfactory, Marginal, or Unsatisfactory. The recoding scheme designed for this study is shown in Table 4.

Table 4: UCI Rating Quantitative Value

Rating (PACAF, and most of USAFE)	**Rating Value**	**Rating** (ACC and some of USAFE)
Outstanding	3	**Complies**
Excellent	2.5	
Satisfactory	2	**Complies with Comments**
Marginal	1.5	
Unsatisfactory	1	**Does not Comply**

Each inspected item was given its corresponding value. This value allowed for a direct comparison between inspection reports. The values were averaged by area of logistics (supply, transportation, or logistics plans) as well as averaged for the overall inspection. The logistics area mean and inspection mean were then averaged by year and by pre-CLR and post-CLR (i.e. before the LRS or after the implementation of the LRS). This approach facilitated comparison of logistics results between the major commands both

before the LRS with their results after the LRS implementation. Data from all major commands was aggregated to better understand the larger picture across the Air Force. Trend analysis was accomplished to determine if the LRS is heading in a positive, negative, or neutral direction based on inspection results.

In addition to the inspection results, NMCS rates were compared to determine positive, negative, or neutral trend by major command. An analysis of this data was accomplished by year, before the LRS and after the LRS implementation. Any trend in NMCS rates is determined to evaluate the performance of the LRS by major command. All NMCS and inspection results were compared to the MC rates collected for each major command. These rates were analyzed by year and compared before the LRS and after the implementation of the LRS.

After compiling all UCI data a standard sample mean was extracted to evaluate the inspection results. Equation 2 below provides the standard formula for a sample mean.

Equation 2: Formula for a Sample Mean

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Where:
X *bar* = mean of sample UCI results
$\sum$ = sum of UCI results in sample
n = number of UCI results in sample

The mean was established for each area of logistics (supply, transportation, or logistics plans) as well as for the overall inspection. The logistics area means and inspection means were then averaged by year and by pre-CLR and post-CLR. Data across all major commands was compiled to better understand the larger picture across the Air Force.

Each major command was compared and results were compared for before the LRS and after the LRS implementation. Trend analysis is accomplished to determine if the LRS is heading in a positive, negative, or neutral direction based on inspection results. All UCI inspection results were used to provide the descriptive statistics presented in Table 5.

Table 5: UCI Descriptive Statistics

UCI Descriptive Statistics	
Mean	2.447087142
Standard Error	0.028494653
Median	2.5
Mode	2.5
Standard Deviation	0.262707716
Sample Variance	0.069015344
Kurtosis	-1.131334628
Skewness	-0.204915969
Range	0.884210526
Minimum	2
Maximum	2.884210526
Sum	208.0024071
Count	85
Largest(1)	2.884210526
Smallest(1)	2
Confidence Level (95.0%)	0.05666474

Data Analysis Method

The methodology used for this research was trend analysis. After all inspection results and NMCS data were collected and trends were established a comparison between NCMS trend, UCI trend, and MC trend was established in Tables 8-10 to determine the

impact the LRS has had on MC rate and compliance. These tables are used to make an inference on the LRS's effectiveness as determined by UCI rate and NMCS rate trends.

Summary

The research of this paper is an empirical analysis of historical quantitative data using trend analysis to determine the effectiveness of the LRS and its impact on aircraft availability. By focusing the research on two forms of data, a quantitative analysis of logistics UCI results and an analysis of NMCS rates this paper will determine the LRS's effectiveness and its impact on aircraft availability.

IV. Analysis and Results

Chapter Overview

This chapter will use the investigative questions presented in chapter one to examine the results of the empirical analysis of historical quantitative data. These results will serve as one indication of the effectiveness of the LRS and its impact on aircraft availability. The inspection data will be presented and examined for any trend in the UCI results from before the LRS and since LRS implementation. NMCS data will be examined to determine any trend and its direct impact on aircraft availability. Both inspection and NMCS data will then be compared to determine any co-relational effect on aircraft availability.

Investigative Questions Answered

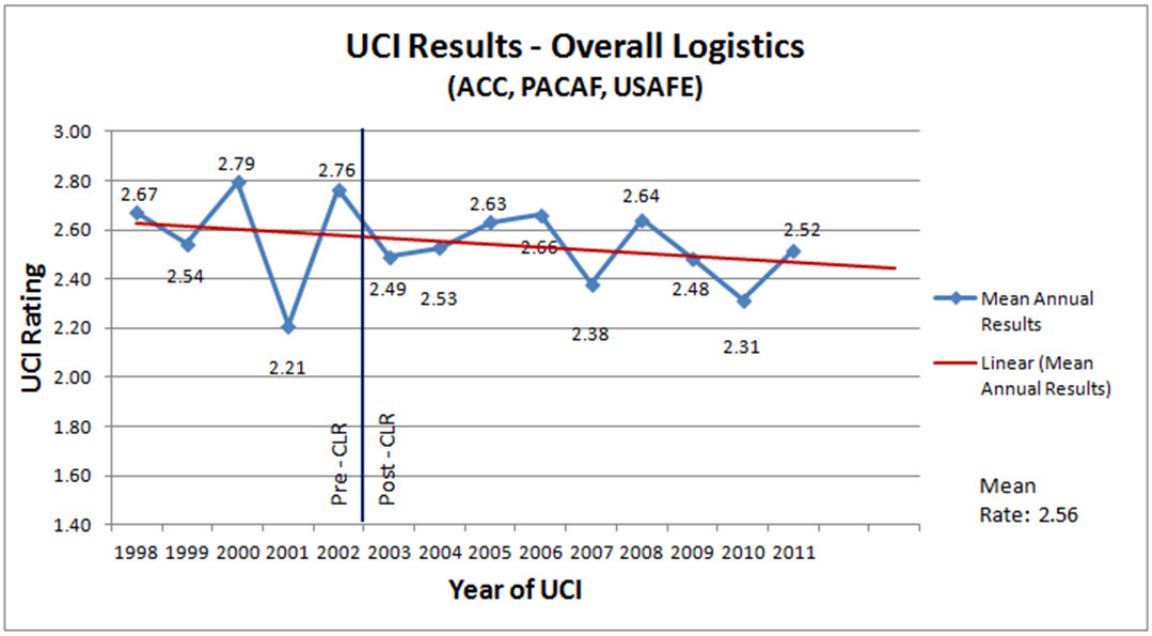
The investigative questions are used as a tool to present the results of the data.

- What is the trend with Supply Squadron, Transportation Squadron, and Logistics Plans section inspection results compared to the trend with LRS inspection results?

Overall UCI Results

Figure 1 below illustrates the overall inspection results and associated trend for all three major commands (ACC, PACAF, and USAFE) over the calendar years from 1998 till 2011.

Figure 1: ACC, PACAF, USAFE Combined UCI Results (CY 1998 – 2011)

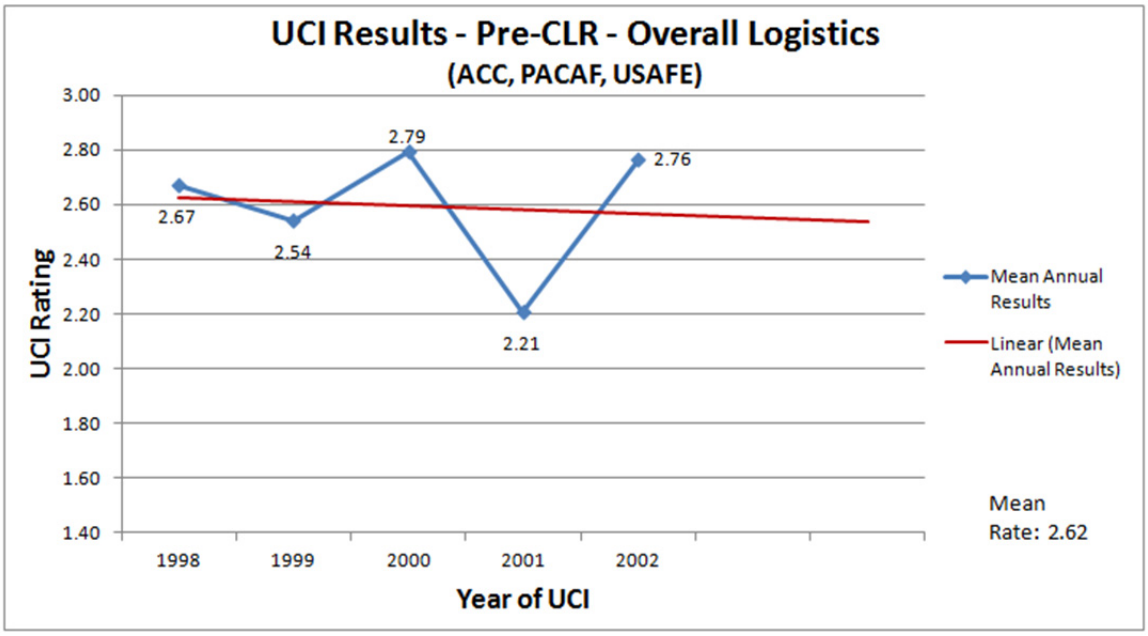


There is a negative trend starting at approximately 2.67 (Rating: excellent or complies with comments) and ending at approximately 2.37 (Rating: satisfactory or complies with comments) over the course of 14 years. While the trend is negative it is a minor trend of only -0.30 points on a scale of 3.00 for a trend of approximately -0.021 per year. Notably there are four significantly lower years, suggesting the operations tempo plays a significant factor in the effectiveness of the Supply, Transportation, or Logistics Readiness Squadrons. These four years coincide with significant events in history. The first event, in 2001 (mean rate of 2.21) was the September 11th terrorist attacks which led to our involvement in the war in Afghanistan. The second lower rate, in 2003 (mean rate of 2.40) coincides with the first year of Operation IRAQI FREEDOM (OIF). The third lower rate, in 2007 (mean rate of 2.21) coincides with the OIF surge of 2007. The final lower rate in 2010 (mean rate of 2.33) coincides with the Afghan war surge in 2010.

These events are significant to inspection results due to higher deployment rate, increase mobilization of organizations, fostered by the LRS, and in increase operations tempo.

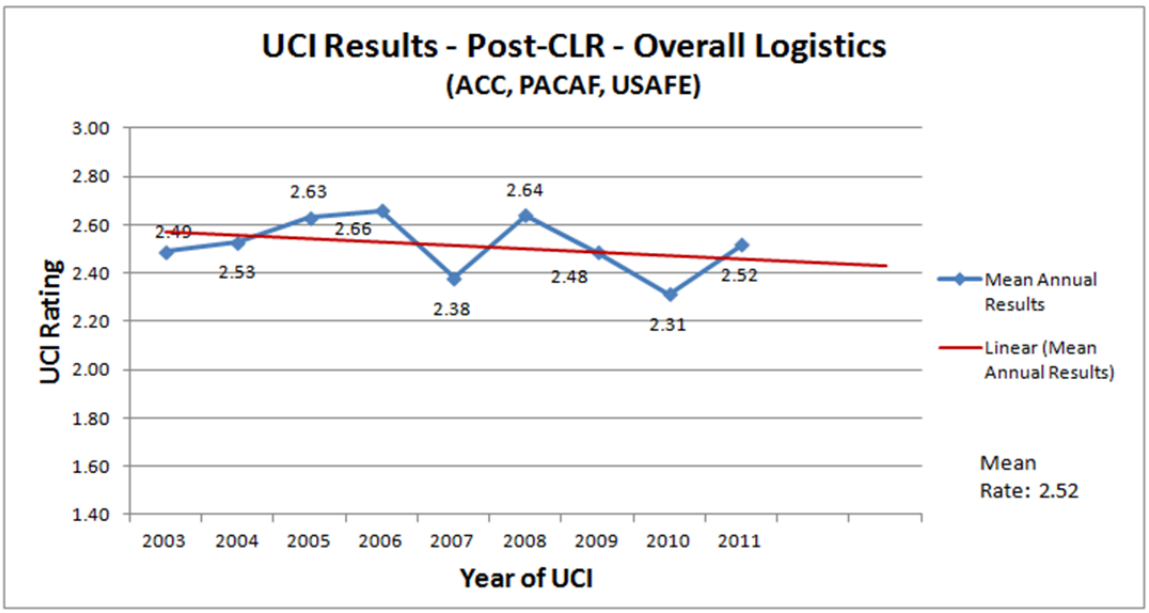
Before the implementation of the LRS inspection rates were higher as seen in Figure 2 below.

Figure 2: ACC, PACAF, USAFE Combined UCI Results (CY 1998 – 2002)



The mean rate before the LRS was 2.62 with a negative trend of approximately -0.05 over the course of five years for a -0.01 per year. The mean rate after the implementation of the LRS was 2.38 with a negative trend of approximately -0.05 over the course of nine years and an annual trend of -0.006 as shown in Figure 3 below.

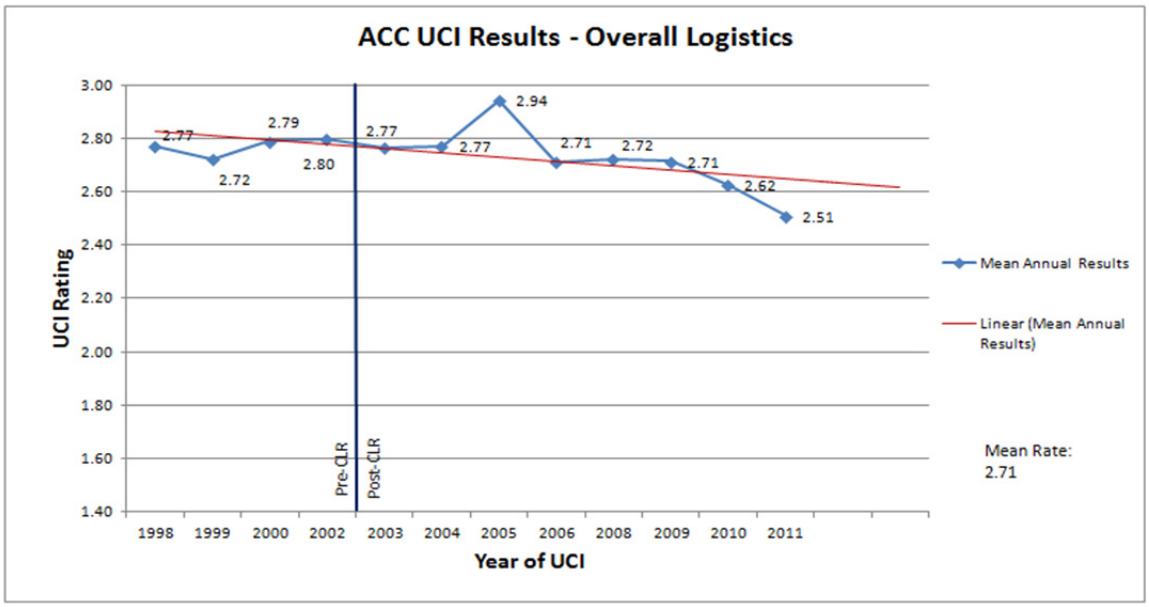
Figure 3: ACC, PACAF, USAFE Combined UCI Results (CY 2003 – 2011)



ACC UCI Results

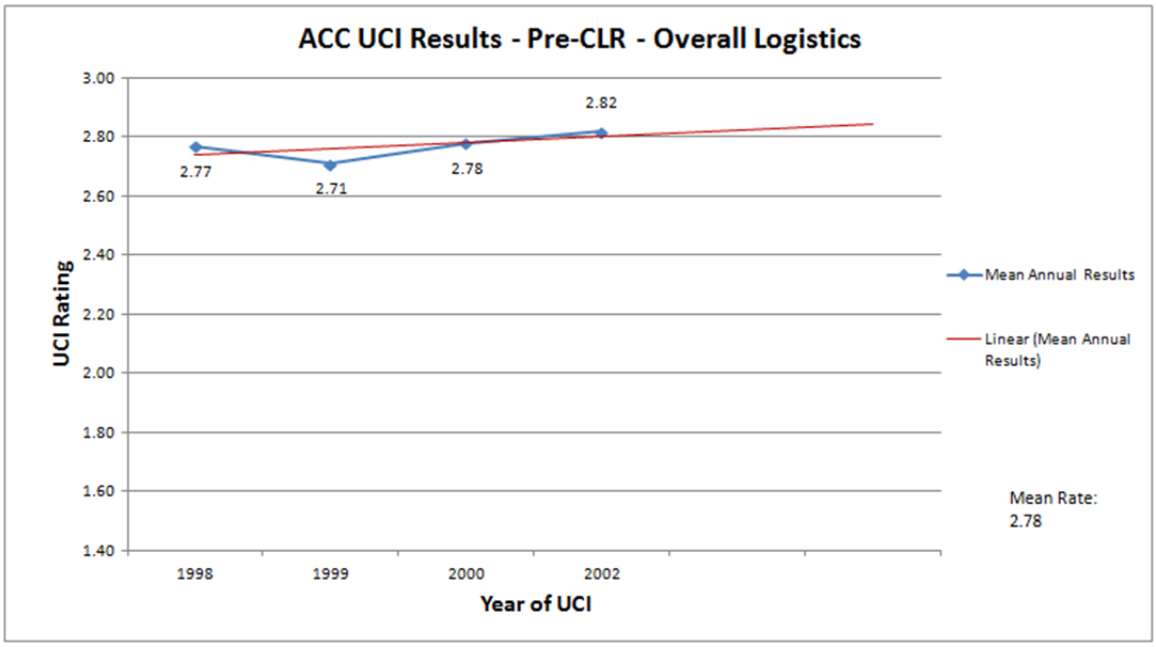
ACC's trend is modestly negative but at an insignificant rate of approximately -0.15 over the past 14 years with an annual trend of approximately -0.01 as shown in Figure 4 below.

Figure 4: ACC UCI Results (CY 1998 – 2011)



This trend may be explained by the balance of both the positive trend in the pre-CLR ACC inspection results trend of approximately +0.06 over the course of four years with an annual trend of approximately +0.015, shown in Figure 5.

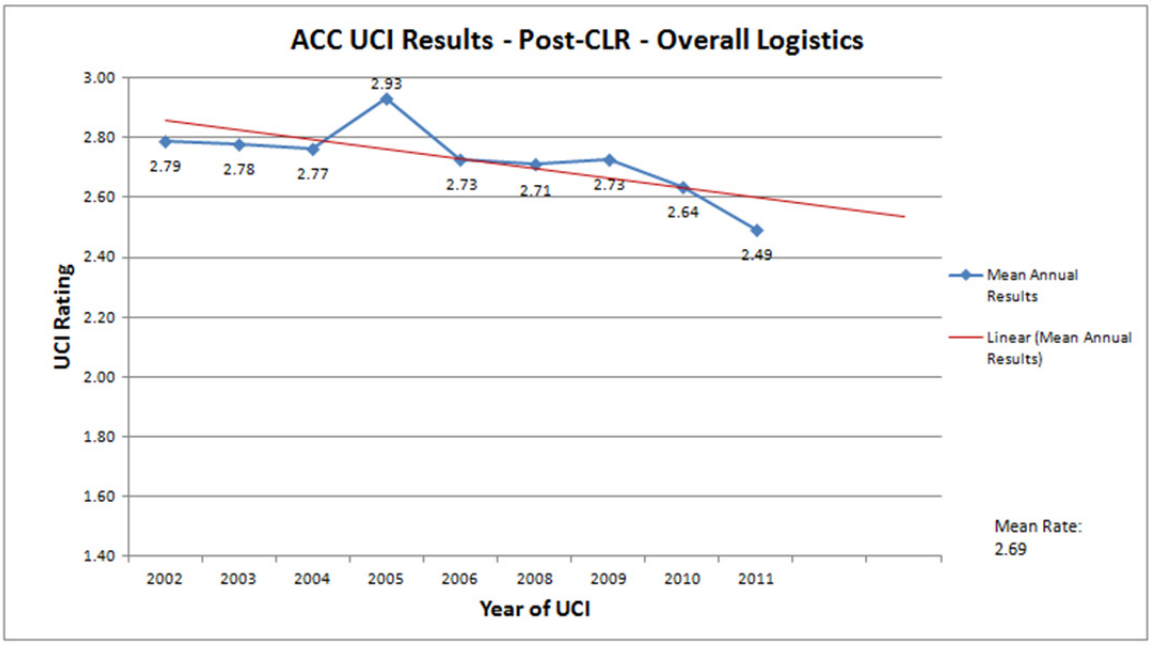
Figure 5: ACC UCI Results (CY 1998 – 2002)



This is balanced with the negative trend in the post-CLR ACC inspection results of approximately -0.25 over the course of nine years for an annual trend of -0.028, shown in Figure 6. Both the pre- and post-CLR mean inspection rates are similar at 2.71 and 2.78 respectively. The implementation of the LRS seems to have an effect on ACC, albeit minor, the effect for ACC has went from a positive trend before the LRS to a negative trend after LRS implementation. Notably, there was no inspection data recorded in 2001 and only one minor inspection for logistics plans reported in 2007 (not in Figure, see Data Collection, p. 21), both years of historic instability. It is assumed ACC placed less importance on the inspection process and more on real world missions for 2001. Since 2009 ACC has demonstrated a significant down turn with inspection results. These mean

results are the lowest results since 1998 and possibly demonstrate a significant down turn in the overall trend.

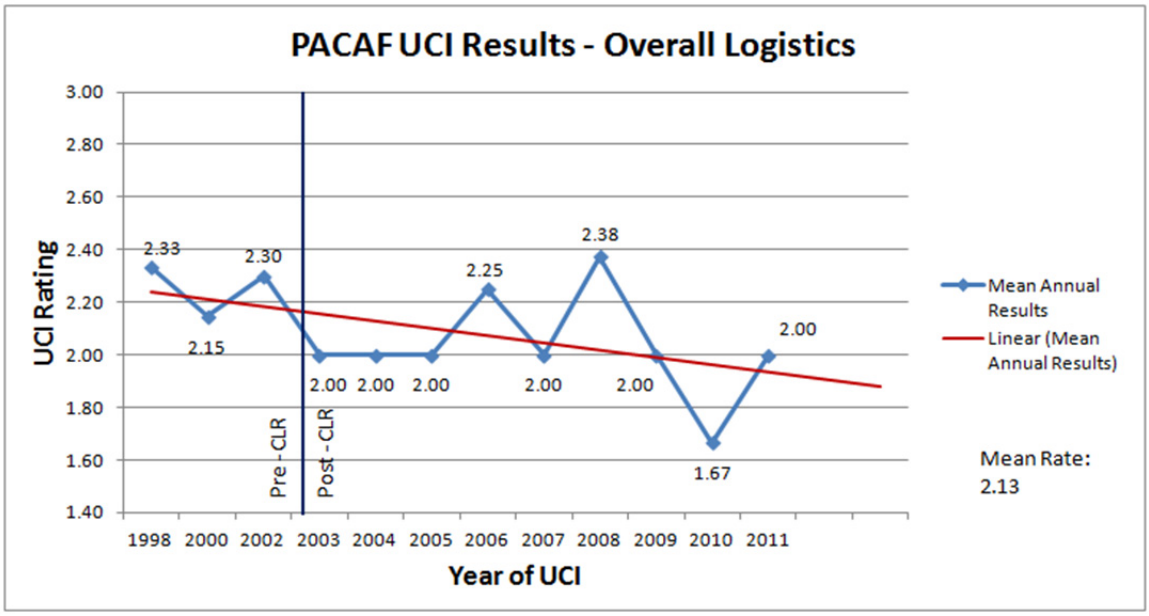
Figure 6: ACC UCI Results (CY 2002 – 2011)



PACAF UCI Results

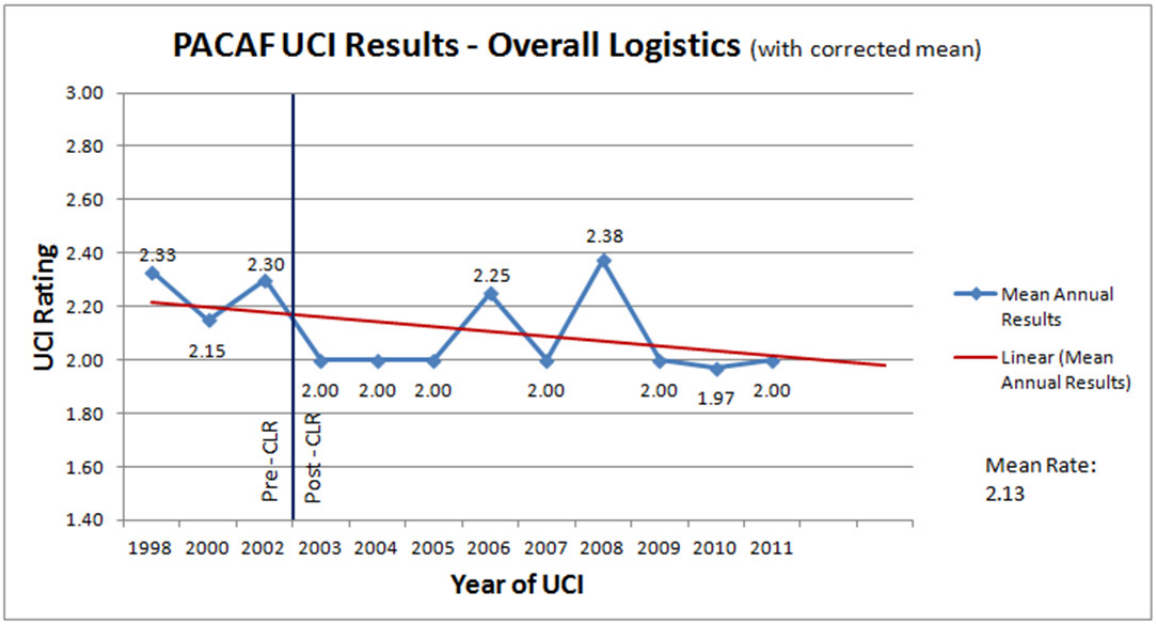
PACAF's inspection results show the greatest negative trend rate of approximately -0.30 with an annual trend of approximately -0.025, as shown in Figure 8. This is a significant trend taking the average inspection result from a satisfactory (2.24) to a marginal (1.94) rating. This negative trend is largely due to the inspection results from 2010.

Figure 7: PACAF UCI Results (CY 1998 – 2011)



Starting in 2003 PACAF changed its inspection process, no longer individually rating each logistics process, supply, transportation, and logistics plans however, rating the LRS as a whole with one overall rating. This process change gave a less accurate representation and stronger weight to the numerical rating assigned to each LRS rating after 2003. In 2010 there were three inspections, an unsatisfactory (1), satisfactory (2), and satisfactory (2) rating for a total mean of 1.67. In contrast three of the four inspections in 2000, an unsatisfactory (1.42), a satisfactory (2.17), and a satisfactory (2.33) rating returned a mean of 1.97. If the rating system of 2010 had more fidelity as in 2000 it would look more like Figure 9. Correcting for 2010 (not corrected for 2003-2009 and 2011) changes the trend rate to approximately -0.20 with an annual trend of -0.017.

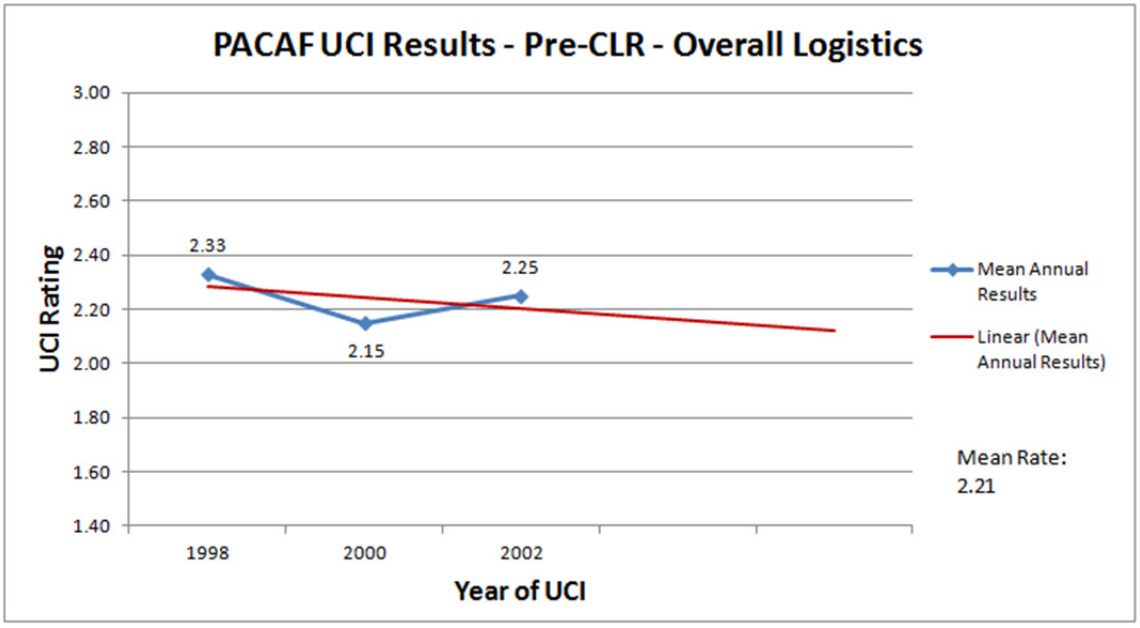
Figure 8: Adjusted PACAF UCI Results (CY 1998 – 2011)



According to the PACAF A4 slideshow titled, "PACAF A4 Issues—LRO/LRS in Crisis," there was one unsatisfactory inspection with 7 major and 24 minor findings. This inspection and resulting slideshow sent out an alarm and caused a significant reaction in the LRO arena. However, putting things in perspective, this is very similar to the year 2000 where there was one excellent, two satisfactory, and one inspection resulting in an unsatisfactory with 20 major and 18 minor findings. In 2000 the additional inspection (excellent) caused an overall better rating than in 2010. One more inspection in 2010 could have completed the year with the same overall result as the year 2000. The PACAF A4 slideshow acknowledges possible causes for the lower rating (HQ PACAF A4) However, while there is an overall minor negative trend and given this is not the first time a PACAF squadron earned an unsatisfactory, it is questionable whether or not the slideshow was the proper response.

PACAF inspection results before the implementation of the LRS had a negative trend of approximately -0.08 over the course of three years for an annual trend of approximately -0.027 as shown in Figure 11.

Figure 9: PACAF UCI Results (CY 1998 – 2002)



The PACAF inspection results after the implementation of the LRS also had a negative trend of approximately -0.22 over the course of 10 years for an annual trend of -0.022 as shown in Figure 12. This further invalidates the reaction in the PACAF A4 slideshow.

Figure 10: PACAF UCI Results (CY 2002 – 2011)

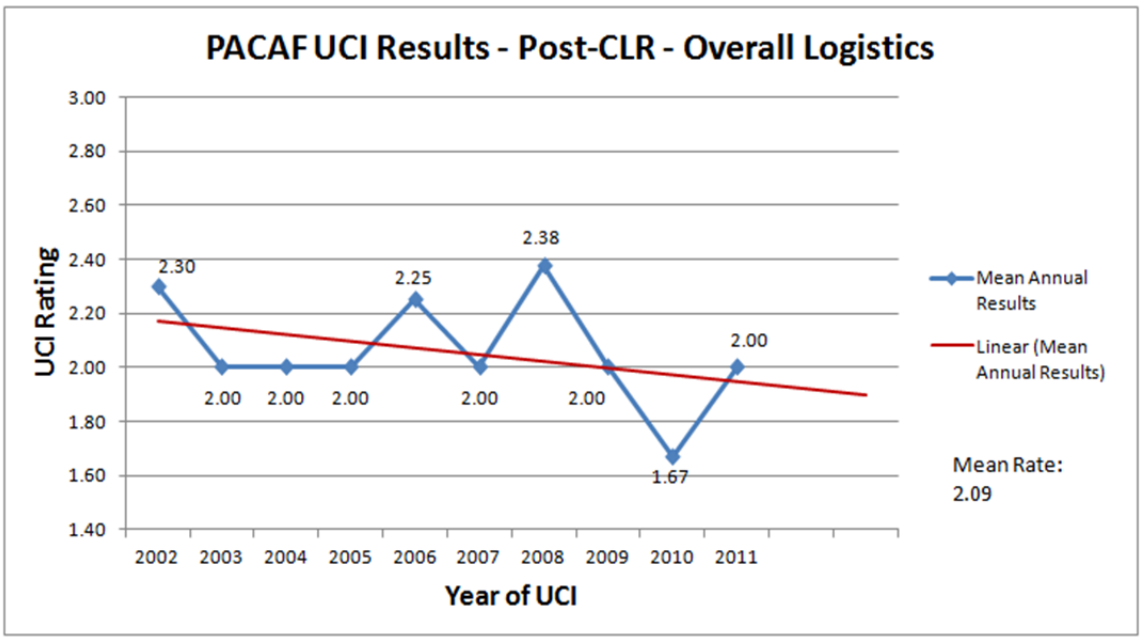
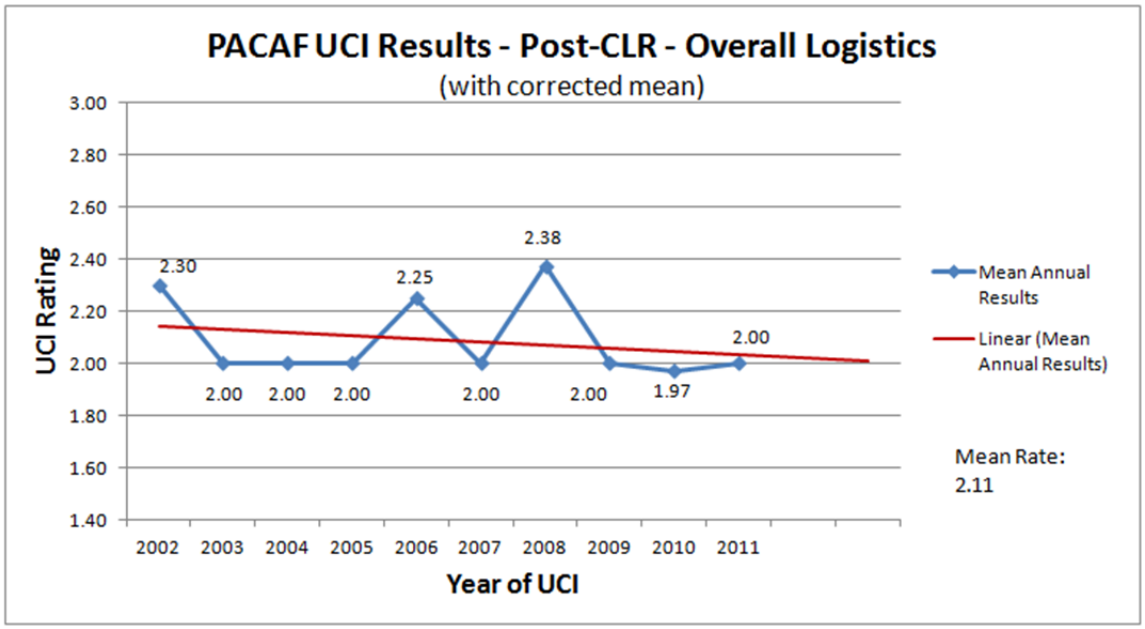


Figure 13 shows the post-CLR results when the 2010 inspection results are adjusted. The trend is still negative at -0.10 over 10 years with an annual trend of -0.01.

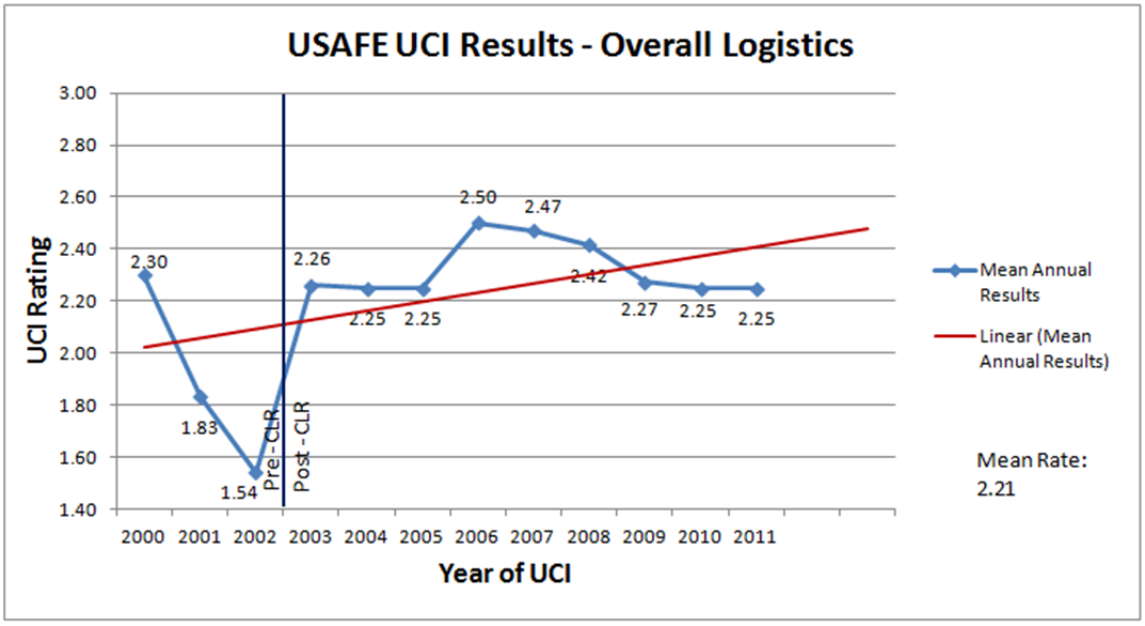
Figure 11: Adjusted PACAF UCI Results (CY 2002 – 2011)



USAFE UCI Results

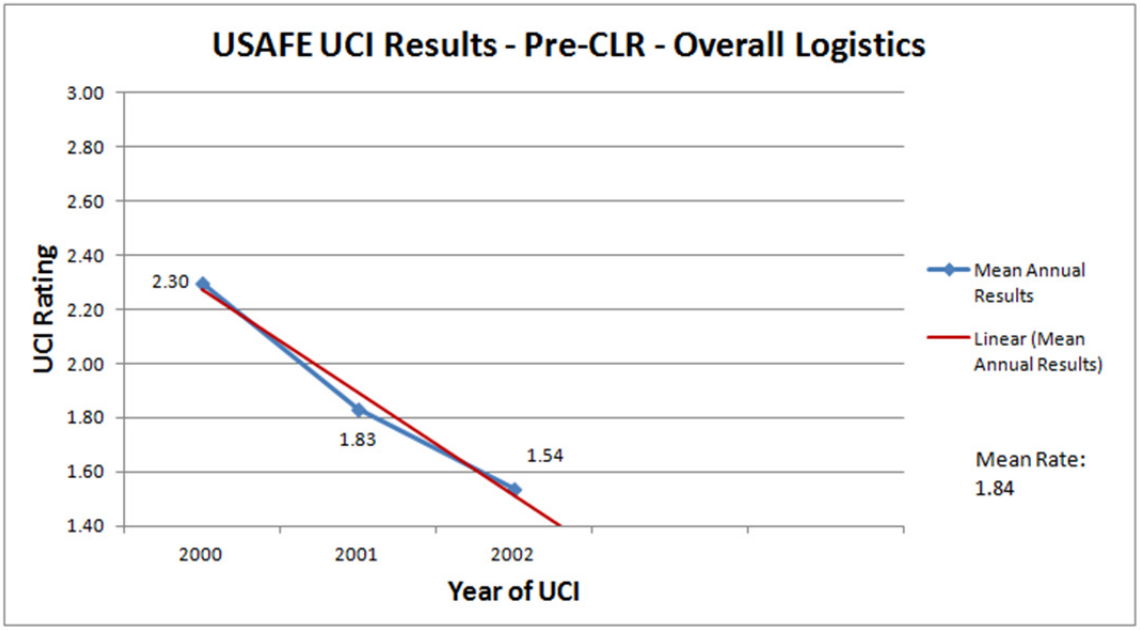
The data for USAFE shows an overall positive trend of +0.39 over the course of 12 years for an annual trend of +0.0325 as shown in Figure 14.

Figure 12: USAFE UCI Results (CY 2000 – 2011)



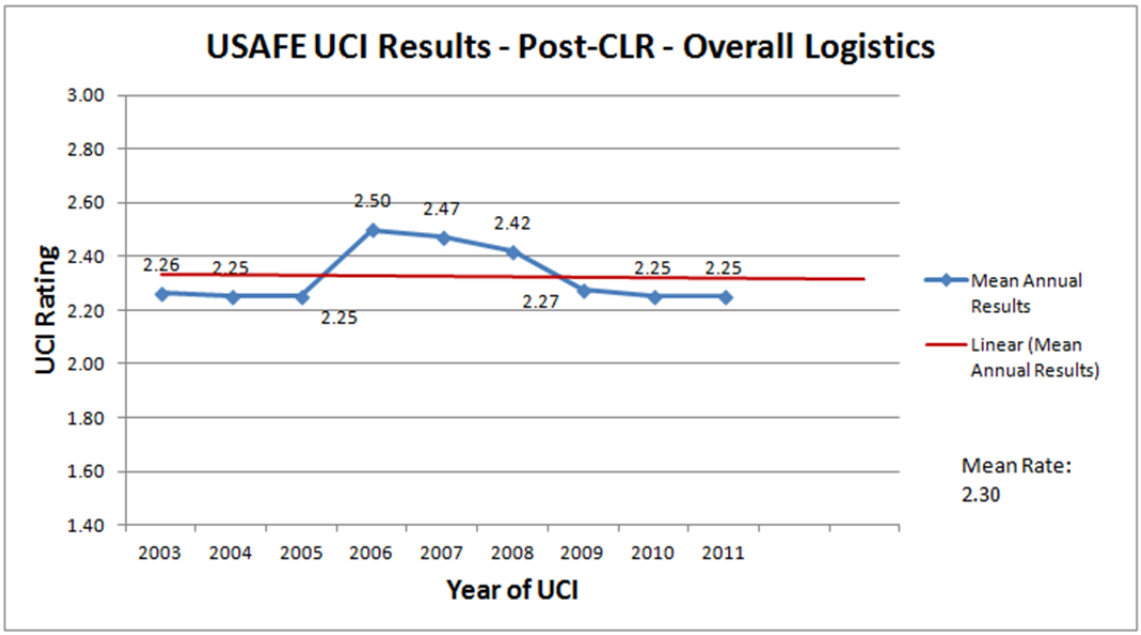
The trend for USAFE before the LRS showed a dramatic negative trend of -0.76 over the course of three years for an annual trend of -0.25 as shown in Figure 15.

Figure 13: USAFE UCI Results (CY 2000 – 2002)



The trend for USAFE after the implementation of the LRS shows a slight negative trend of -0.015 over the course of nine years for an annual trend of -0.0017 as shown in Figure 16.

Figure 14: USAFE UCI Results (CY 2003 – 2011)



However combining both before (mean inspection rate of 1.84) and after (mean inspection rate of 2.3) the trend results are positive. This higher mean inspection rate may result from a difference in the inspection methods after the implementation of the LRS.

All trend rates for each major command, before the LRS, after the implementation of the LRS, and overall are outlined in Table 6.

Table 6: Trend Rates – Squadron Level

Major Command	Approximate Trend Rate		
	Overall	Pre-CLR	Post-CLR
All Four MAJCOMs	-0.021	-0.01	-0.006
ACC	-0.01	+0.015	-0.028
PACAF	-0.027	-0.022	-0.025
PACAF Adjusted	--	-0.01	-0.017
USAFE	+0.0325	-0.25	-0.0017

Overall the only significant trend identified was the Pre-CLR trend for USAFE.

The second investigative question places the focus on the individual logistics processes, supply, transportation, and logistics plans.

- What is the trend with specific logistics processes (supply, transportation, and logistics plans) based on inspection results before the implementation of the LRS and after the implementation of the LRS?

  ACC UCI Results

  ACC trends are data for supply, transportation, and logistics plans are shown in Figures 17 – 25. The trend rate for the process level is shown in Table 7.

Figure 15: ACC UCI Results for Supply (CY 1998 – 2011)

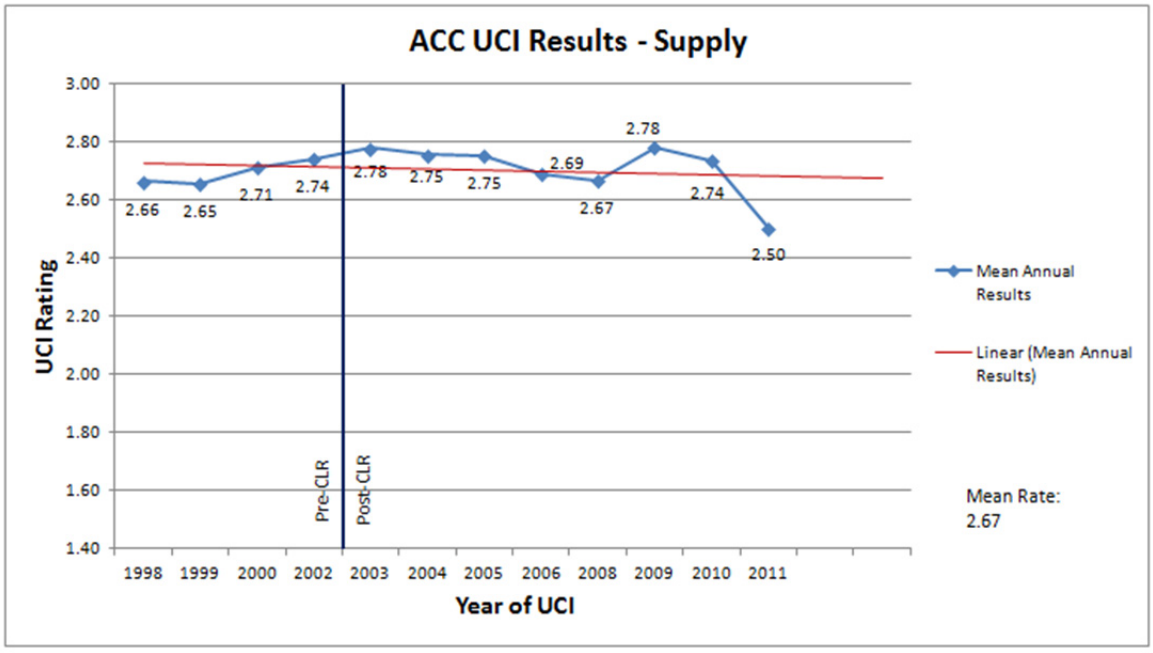


Figure 16: ACC UCI Results for Supply (CY 1998 – 2002)

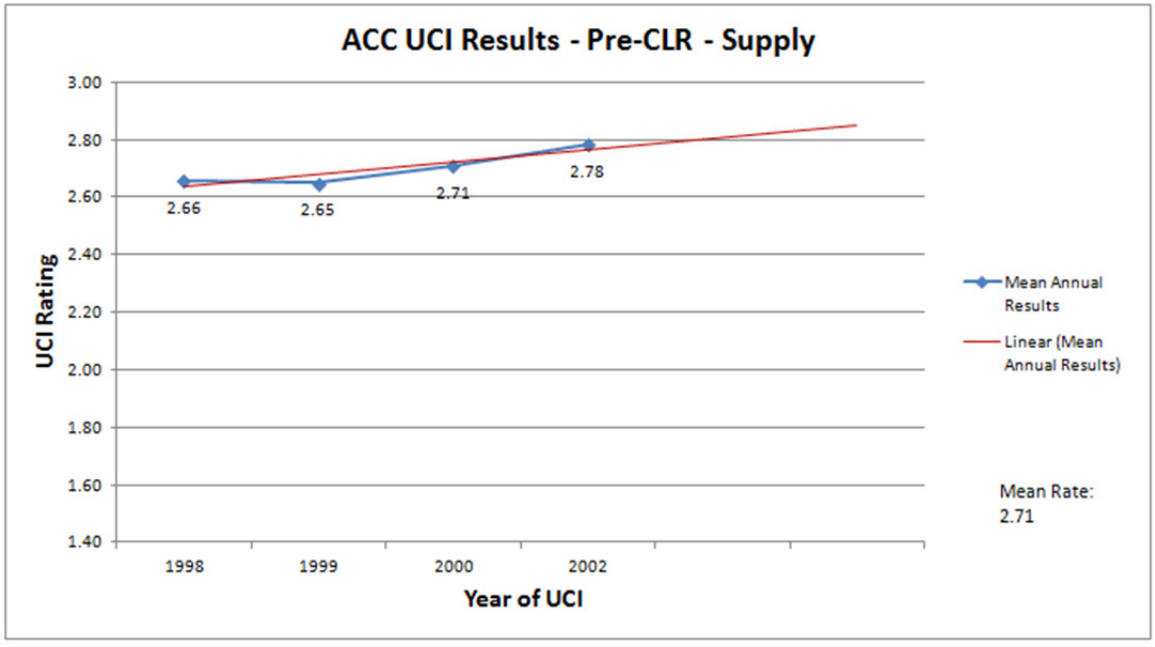


Figure 17: ACC UCI Results for Supply (CY 2002 – 2011)

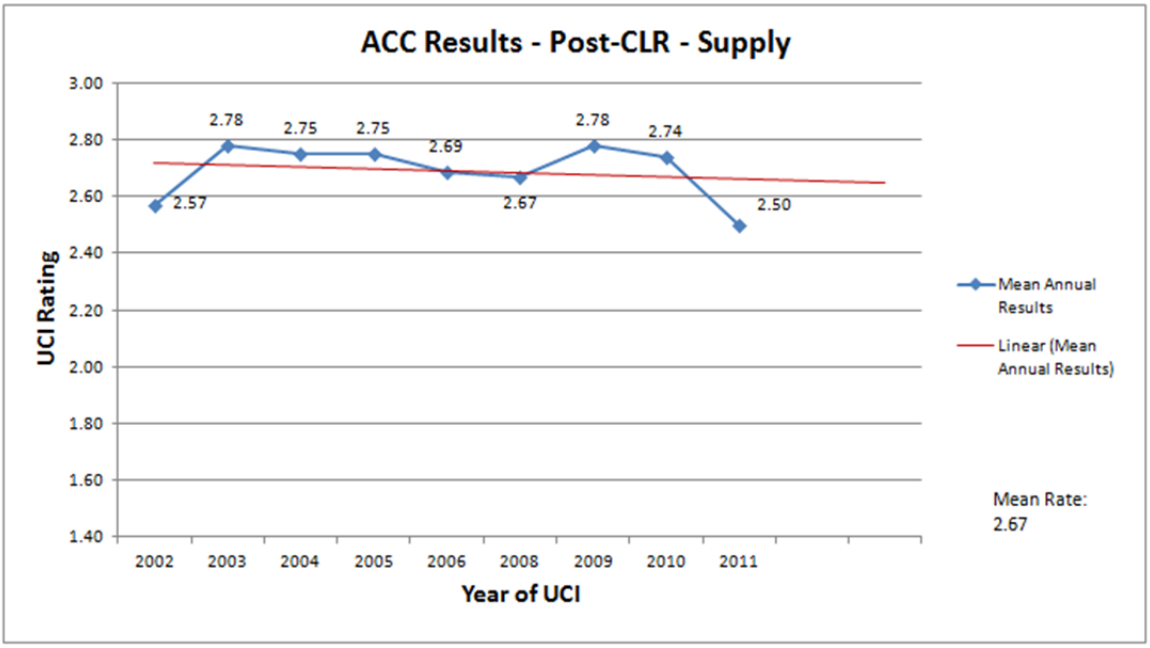


Figure 18: ACC UCI Results for Transportation (CY 1998 – 2011)

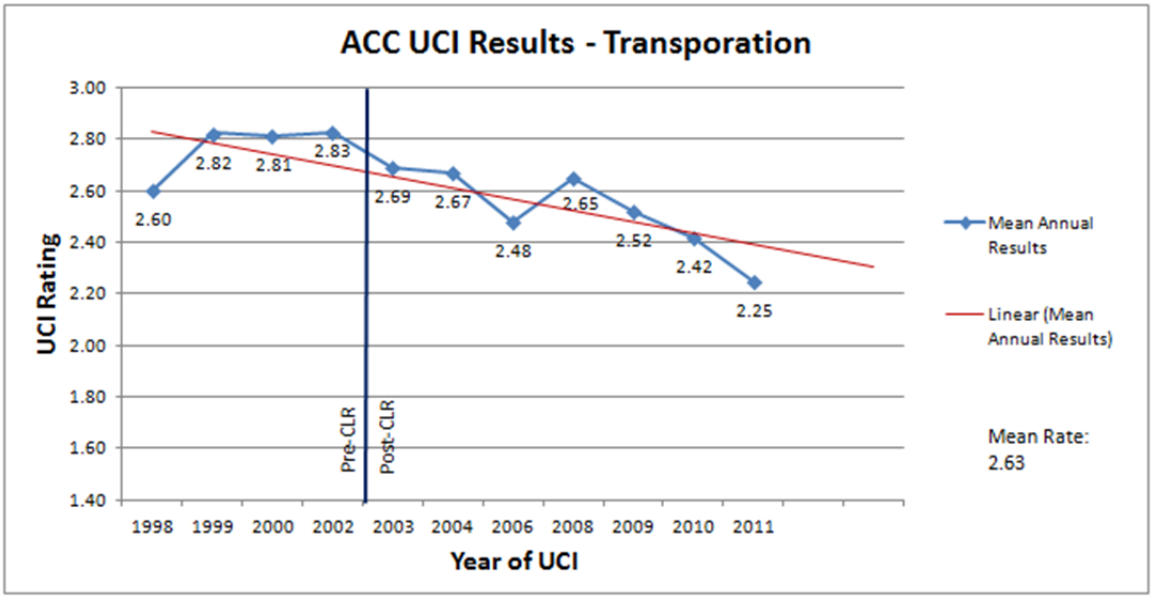


Figure 19: ACC UCI Results for Transportation (CY 1998 – 2011)

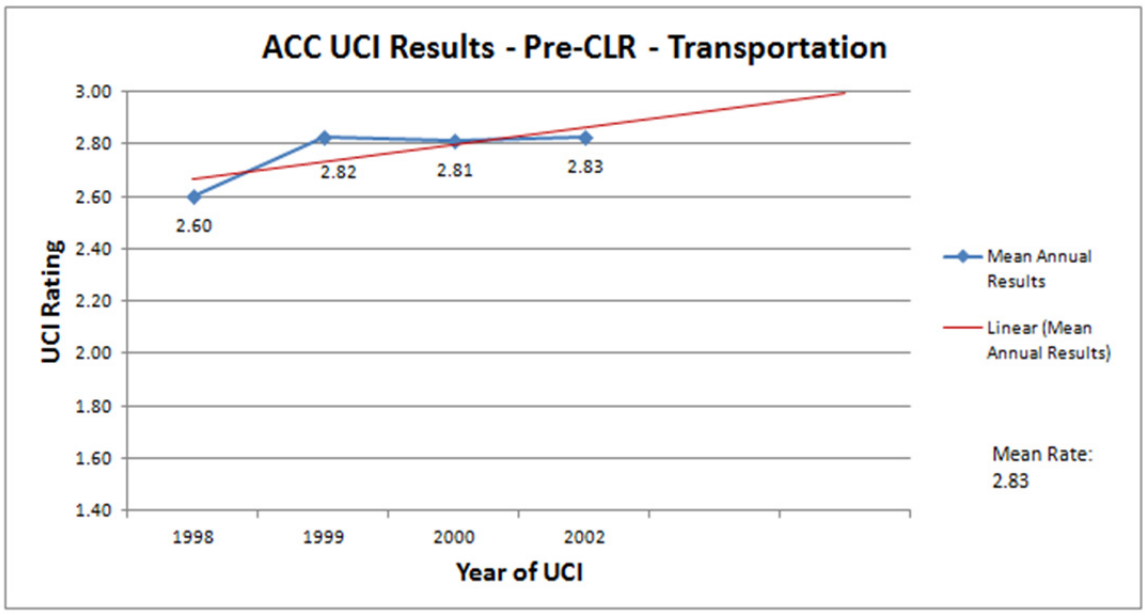


Figure 20: ACC UCI Results for Transportation (CY 2003 – 2011)

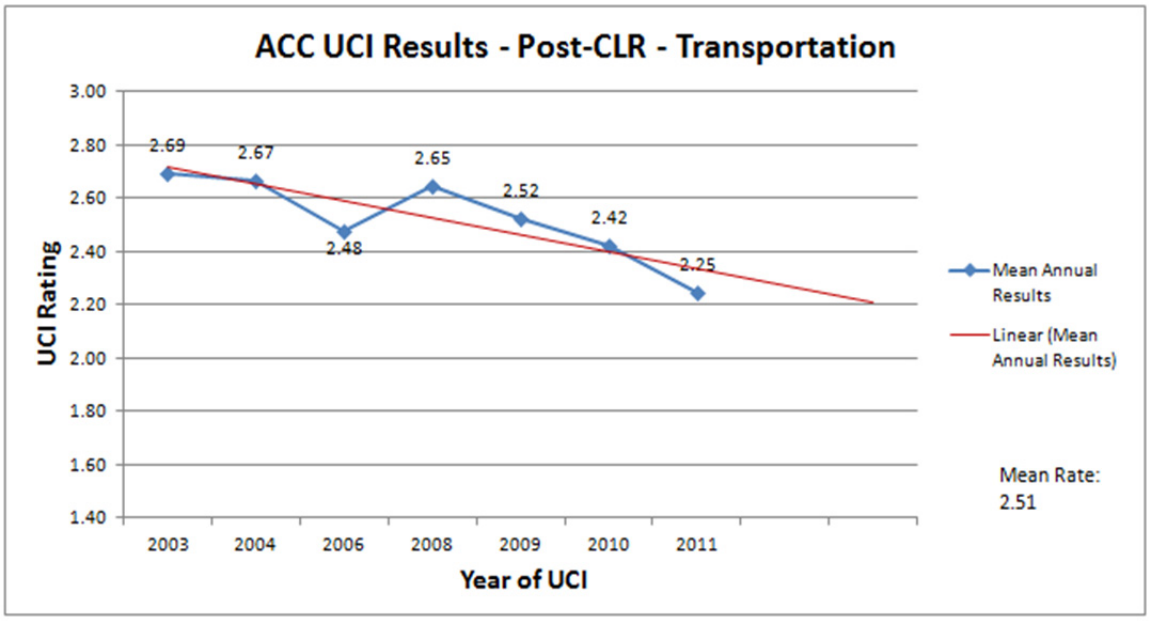


Figure 21: ACC UCI Results for Logistics Plans (CY 1998 – 2011)

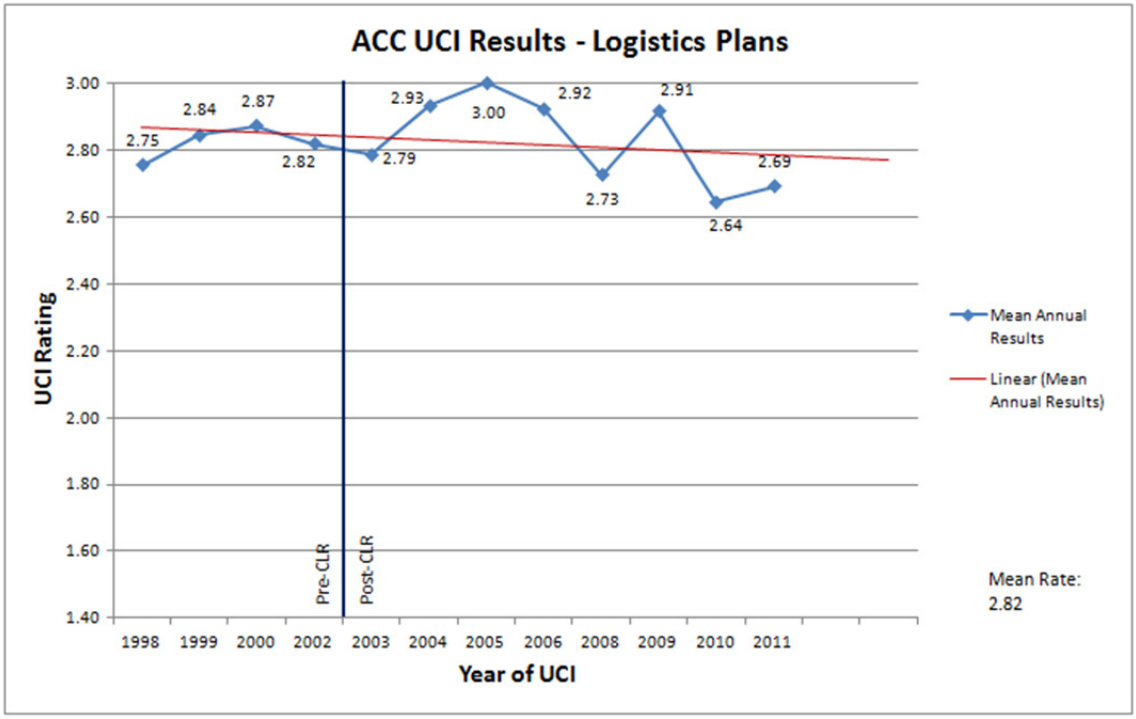


Figure 22: ACC UCI Results for Logistics Plans (CY 1998 – 2002)

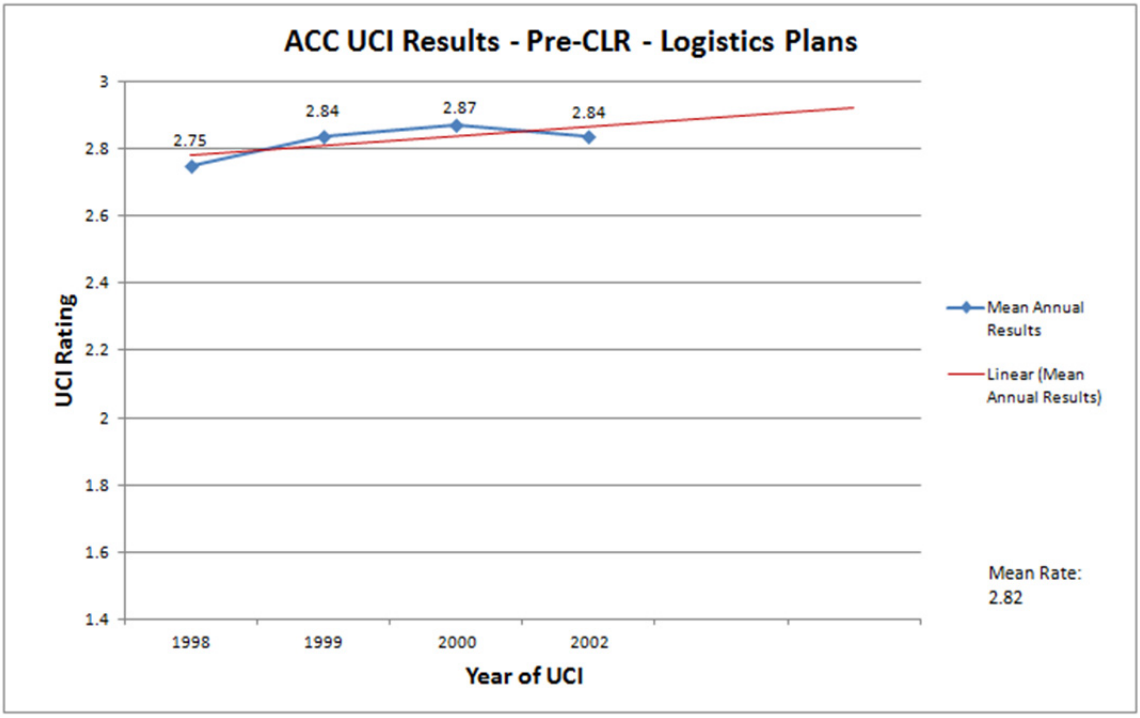


Figure 23: ACC UCI Results for Logistics Plans (CY 2002 – 2011)

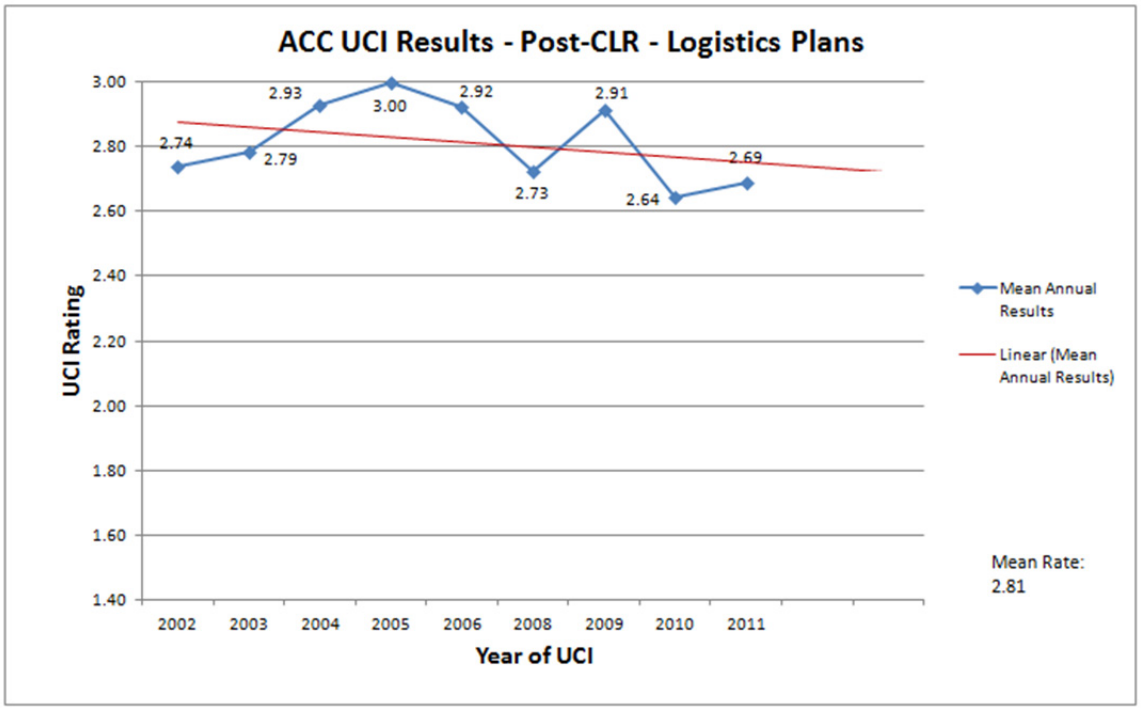


Table 7: ACC Trend Rates – Process Level (Supply, Transportation, and Logistics Plans)

Major Command	Approximate Trend Rate		
	Overall	Pre-CLR	Post-CLR
ACC Supply	-0.033	+0.0325	-0.0056
ACC Transportation	-0.038	+0.045	-0.054
ACC Logistics Plans	-0.0075	+0.0225	-0.014

Both USAFE and PACAF changed their inspection process to only provide an overall rating for the LRS versus a rating for each process area. Therefore, there is not enough data for either major command to provide a process breakdown for the post-CLR. It is notable that prior to the LRS implementation ACC had a positive trend in all areas and a negative trend in all areas after the implementation of the LRS.

The final investigative question involves the NMCS rate for each major command.

- What is the trend with the NMCS rates before the implementation of the LRS and after the implementation of the LRS to determine the effect of the LRS?

When comparing NMCS rates for ACC, USAFE, and PACAF from before and after the LRS implementation there is a positive trend overall as shown in Figures 24 a positive trend before the implementation of the LRS as shown in Figure 25, and a neutral trend as shown in Figure 26. Note a downward trend in NMCS rate is the desired effect and therefore a positive trend.

Figure 24: ACC, USAFE, PACAF Combined Not Mission Capable for Supply Rate (CY 1998 – 2012)

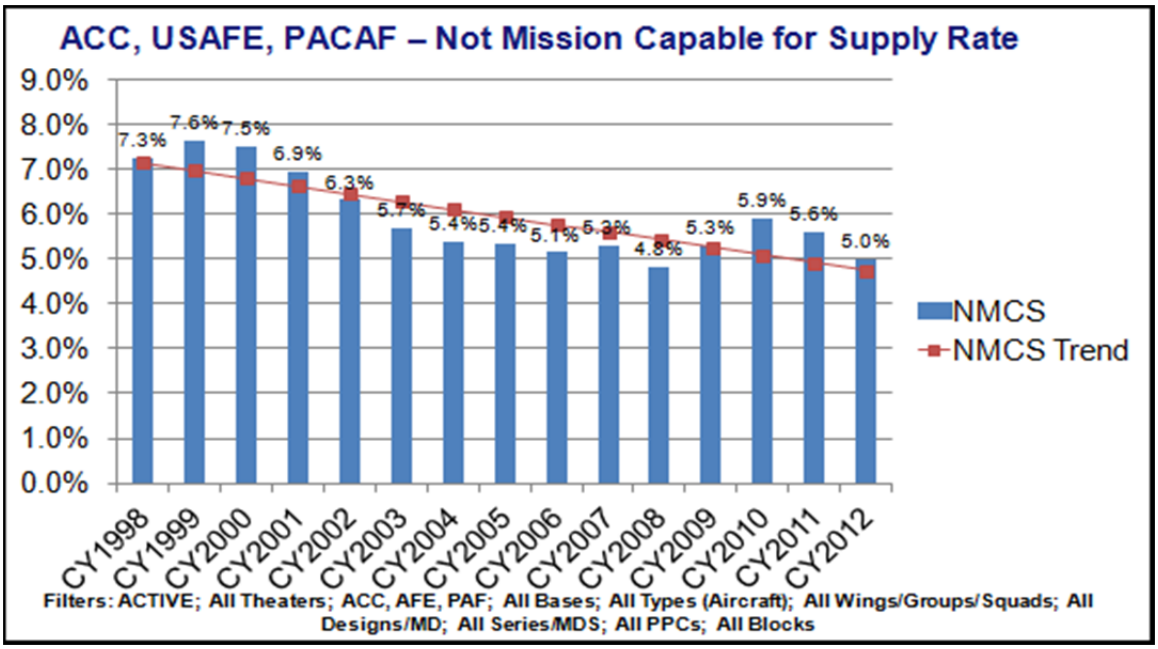


Figure 25: ACC, USAFE, PACAF Combined Not Mission Capable for Supply Rate (CY 1998 – 2002)

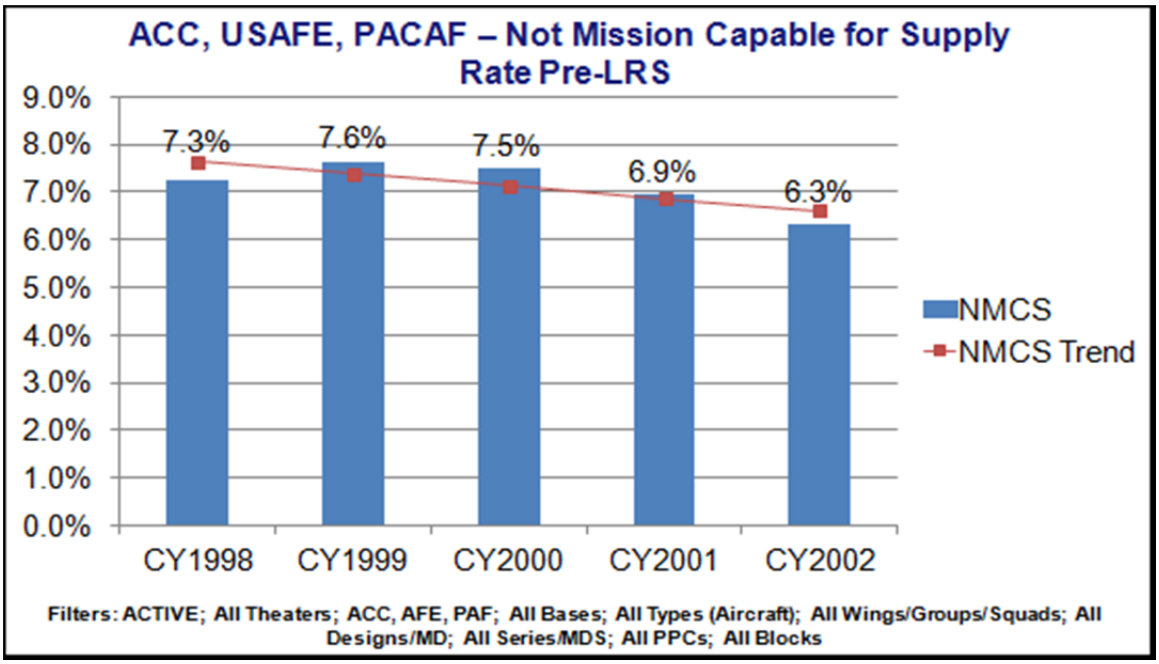
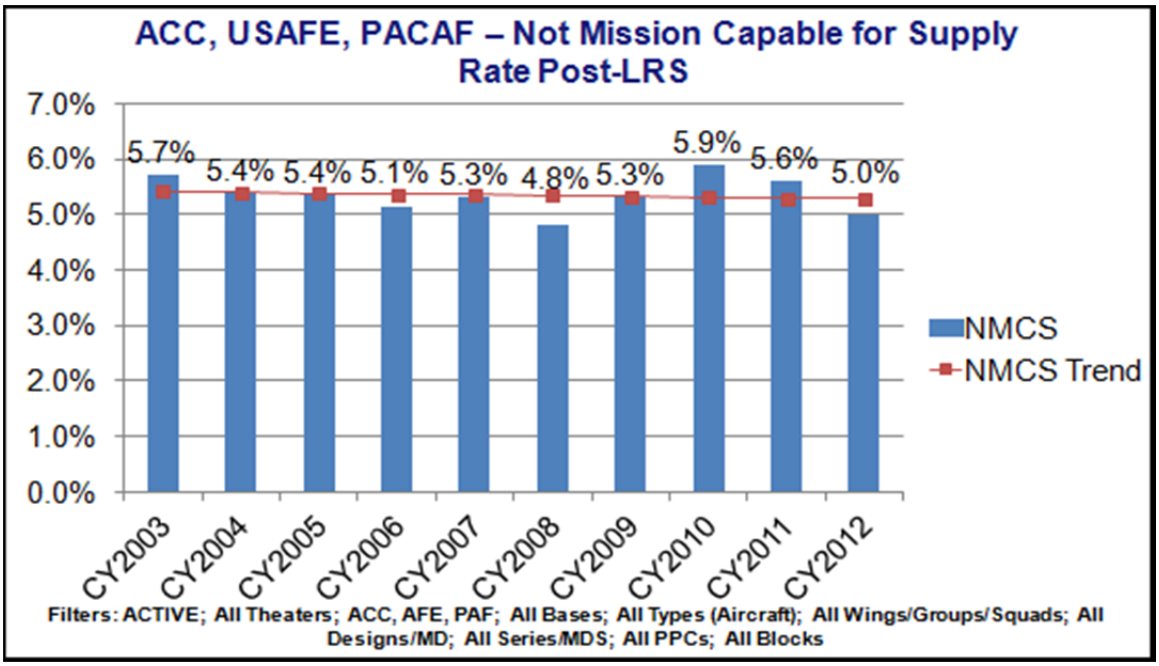


Figure 26: ACC, USAFE, PACAF Combined Not Mission Capable for Supply Rate (CY 2003 – 2012)



ACC shows an overall positive NMCS trend with a positive trend before the implementation of the LRS, shown in Figures 27 and 28. However there is a neutral NMCS trend after the implementation of the LRS as shown in Figure 29.

Figure 27: ACC Not Mission Capable for Supply Rate (CY 1998 – 2012)

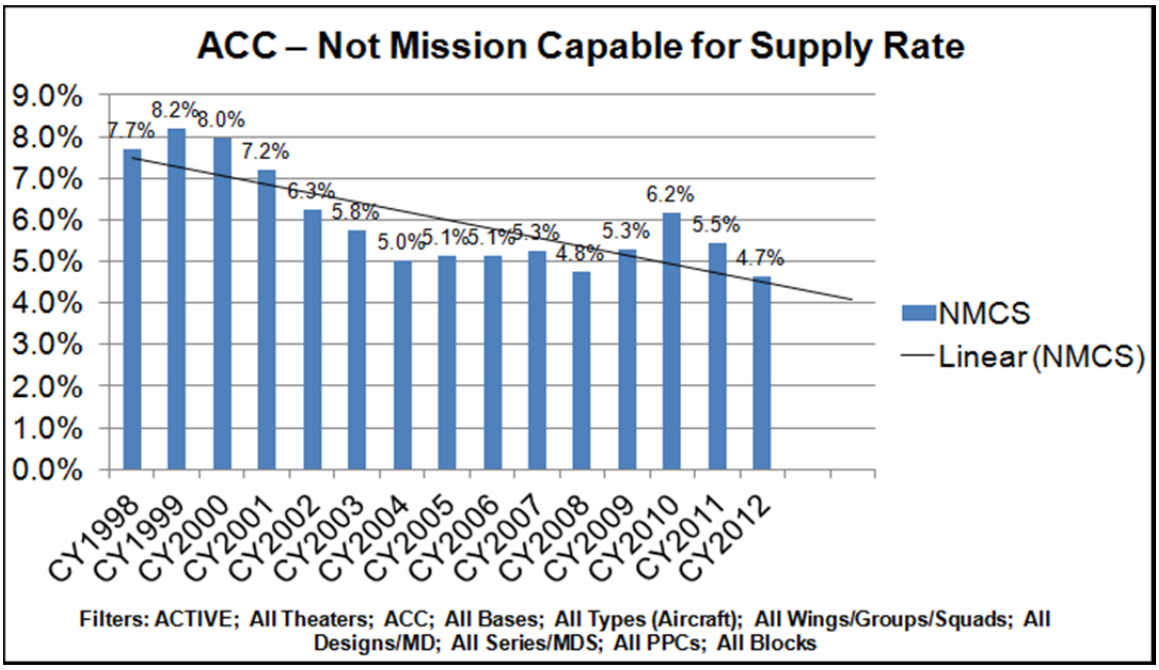


Figure 28: ACC Not Mission Capable for Supply Rate (CY 1998 – 2002)

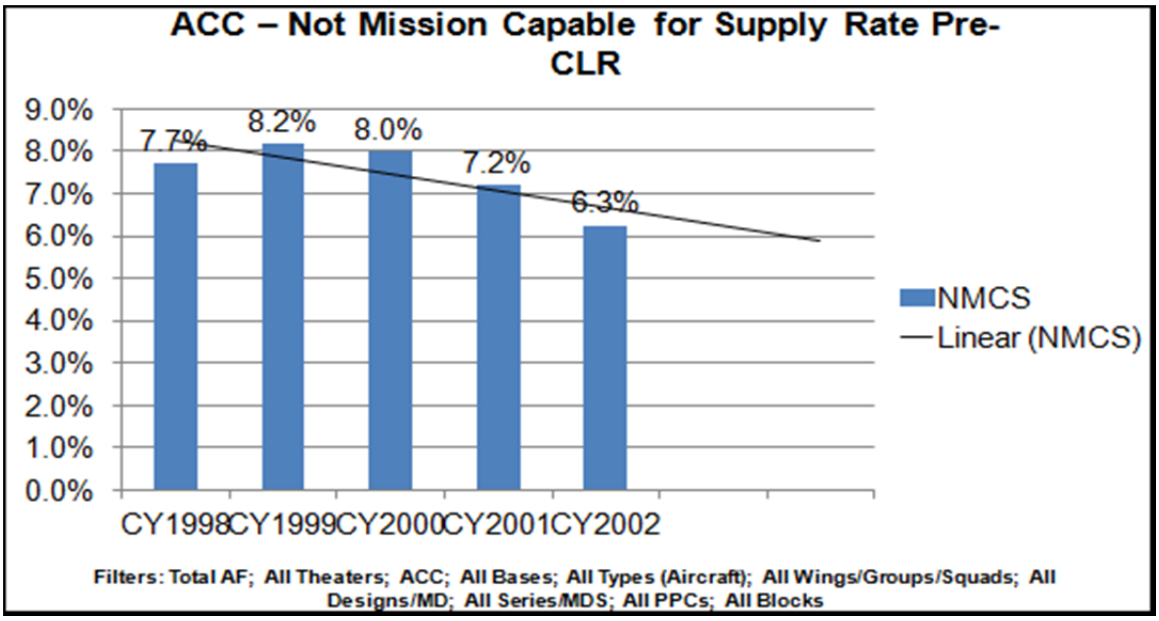
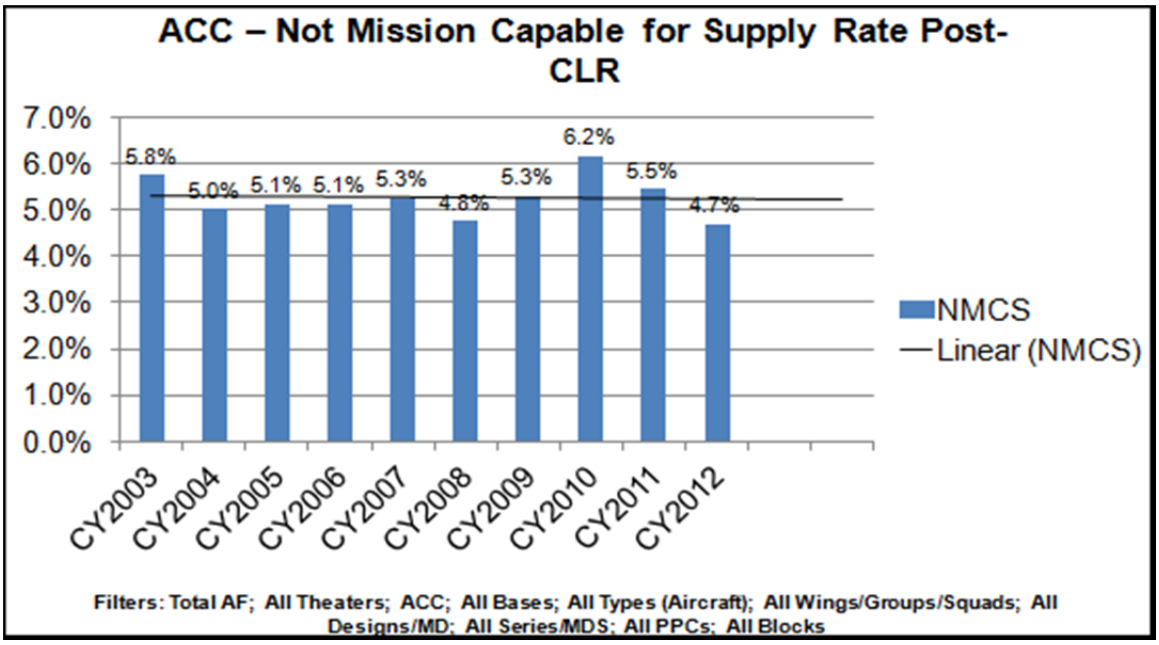


Figure 29: ACC Not Mission Capable for Supply Rate (CY 2003 – 2012)



While the overall USAFE NMCS rate is neutral to positive as shown in Figure 30, the before and after LRS implementation rate show a negative trend, shown in Figures 31 and 32.

Figure 30: USAFE Not Mission Capable for Supply Rate (CY 1998 – 2012)

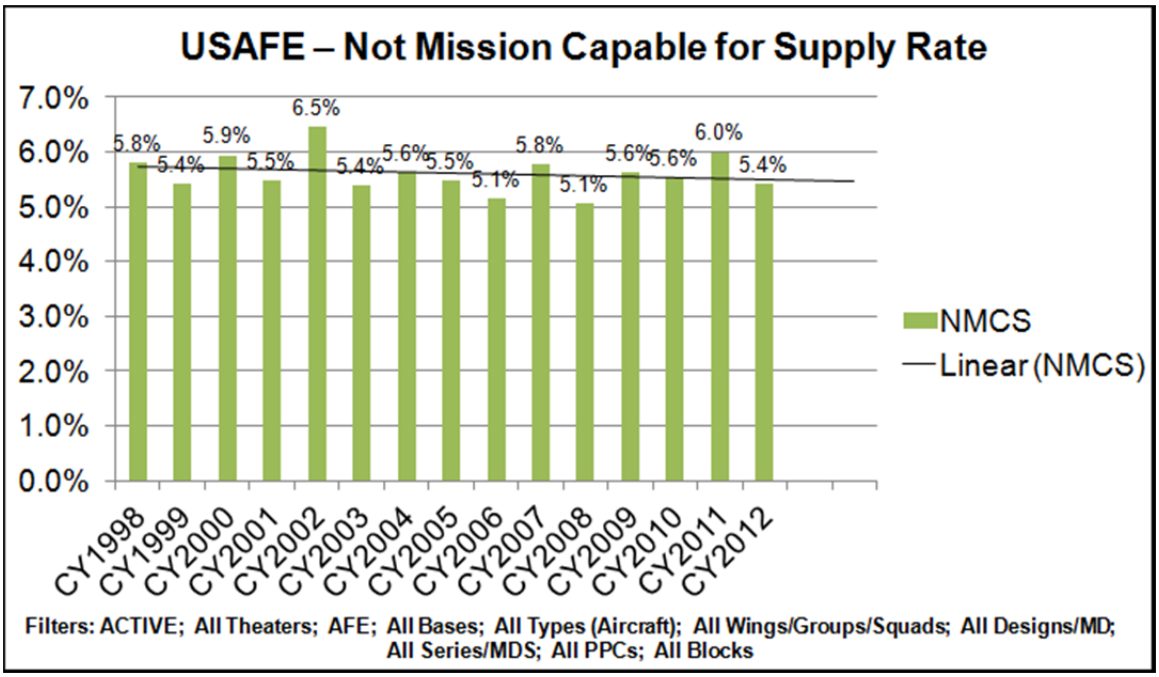


Figure 31: USAFE Not Mission Capable for Supply Rate (CY 1998 – 2002)

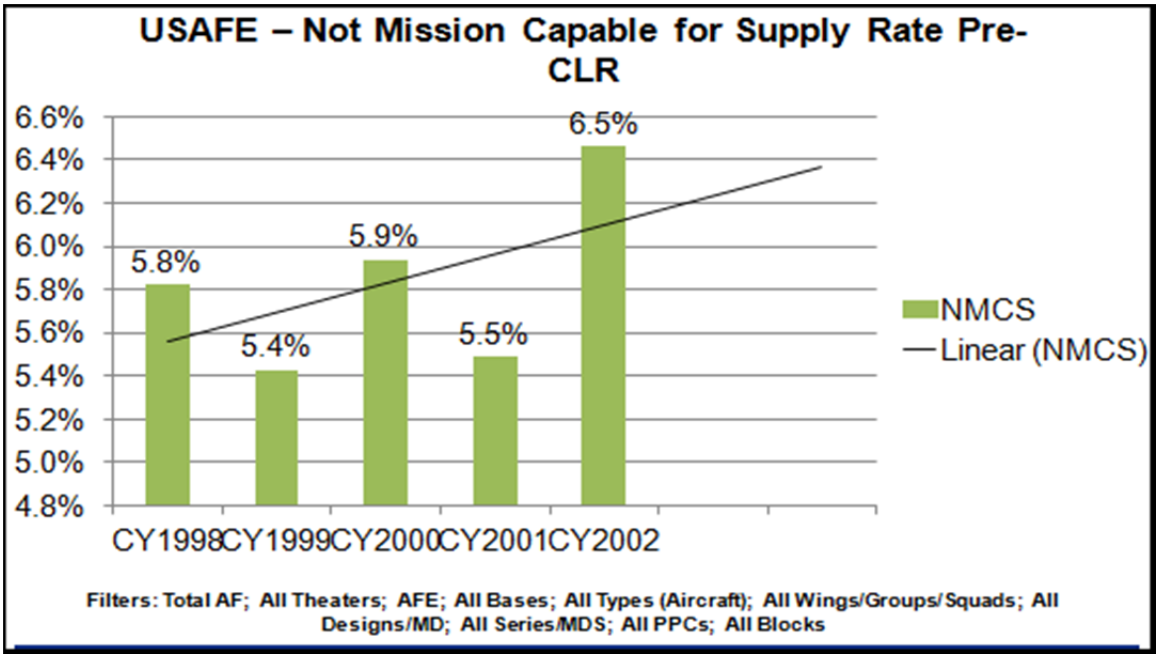
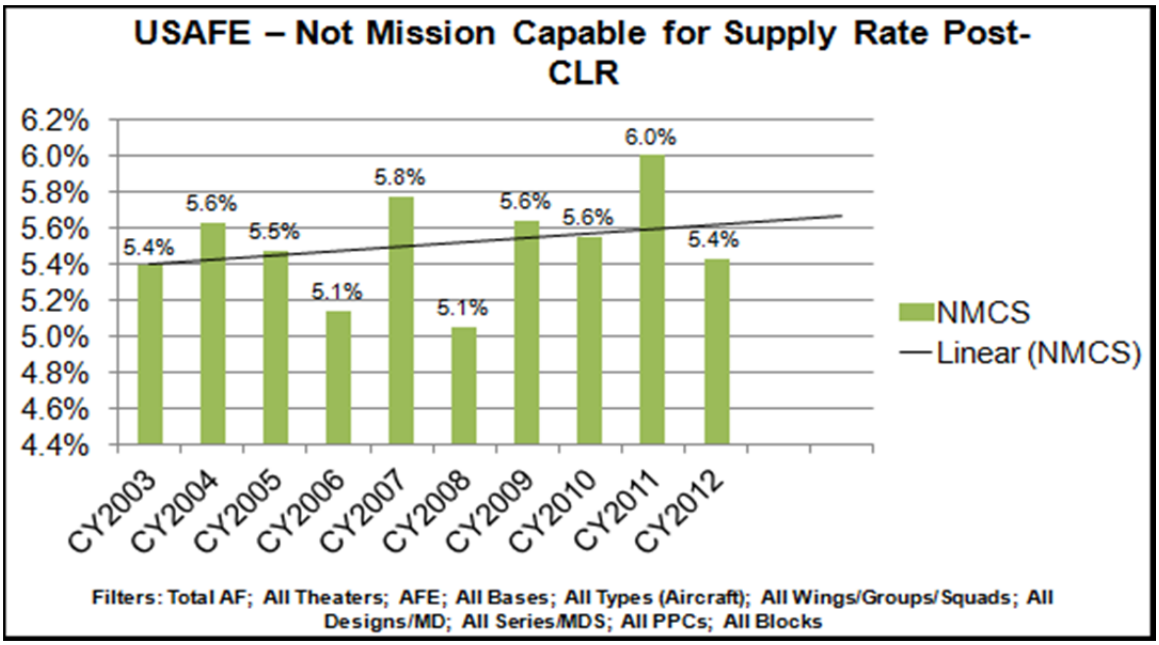


Figure 32: USAFE Not Mission Capable for Supply Rate (CY 2003 – 2012)



Both before and after the implementation of the LRS as well as overall PACAF has a positive NMCS rate trend as shown below in Figures 33, 34, and 35.

Figure 33: PACAF Not Mission Capable for Supply Rate (CY 1998 – 2012)

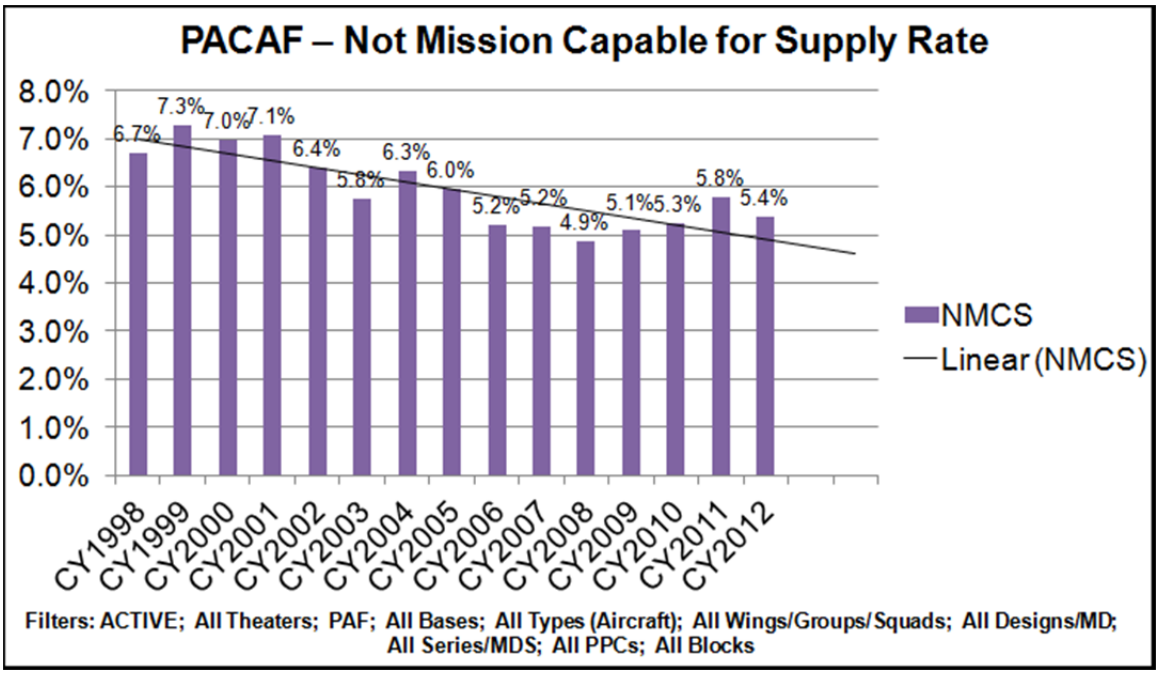


Figure 34: PACAF Not Mission Capable for Supply Rate (CY 1998 – 2002)

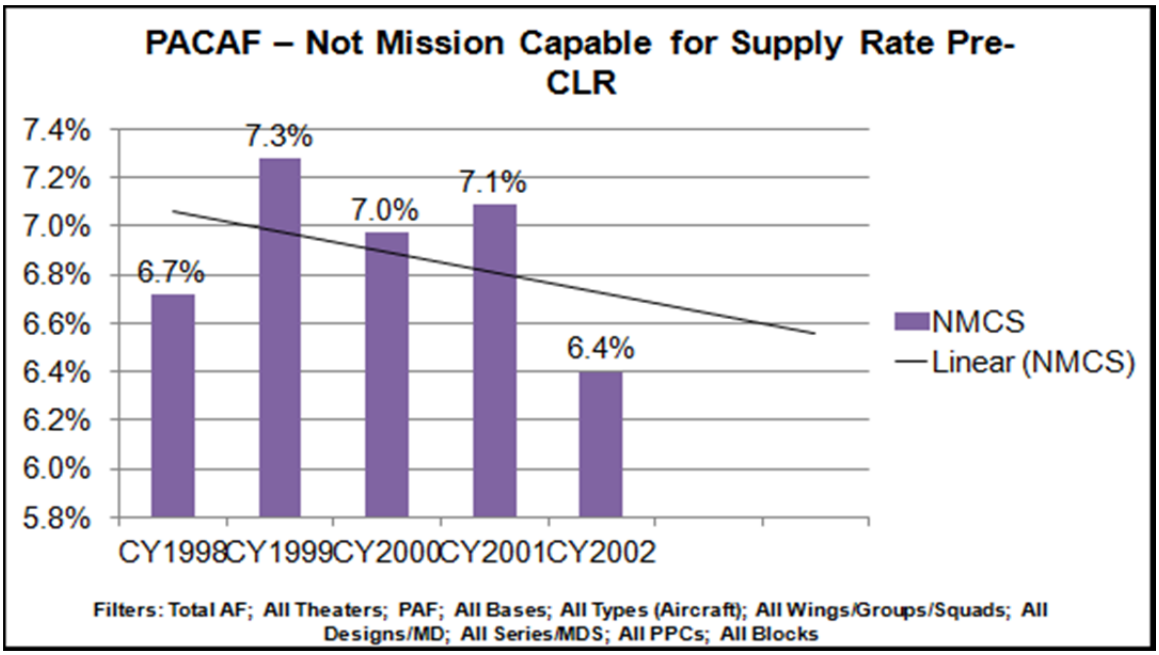
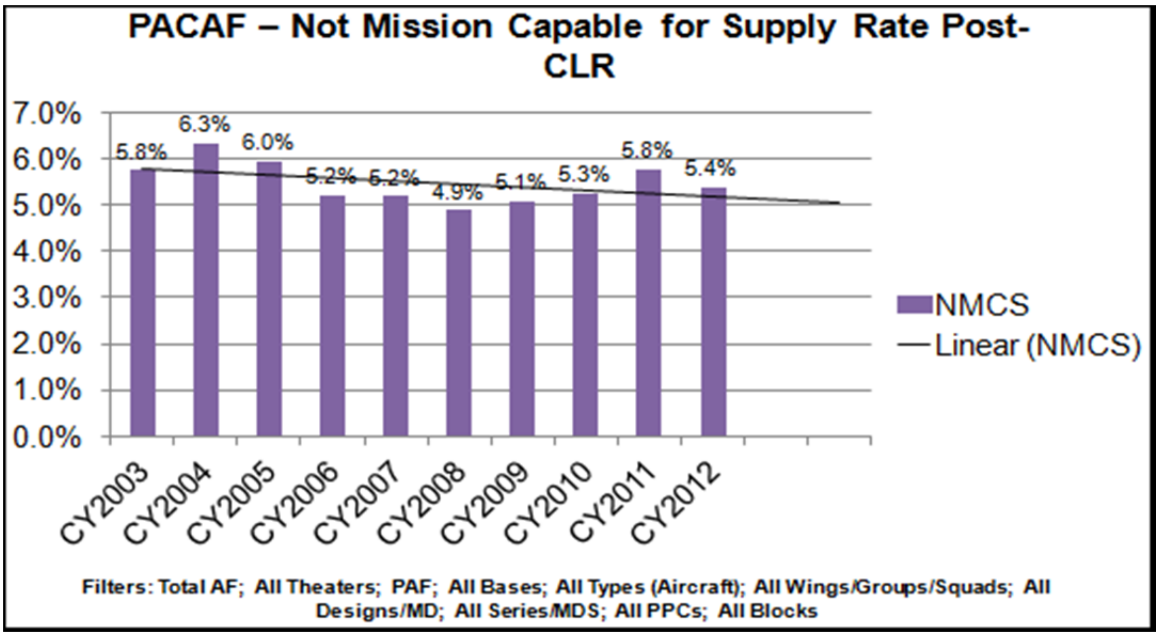
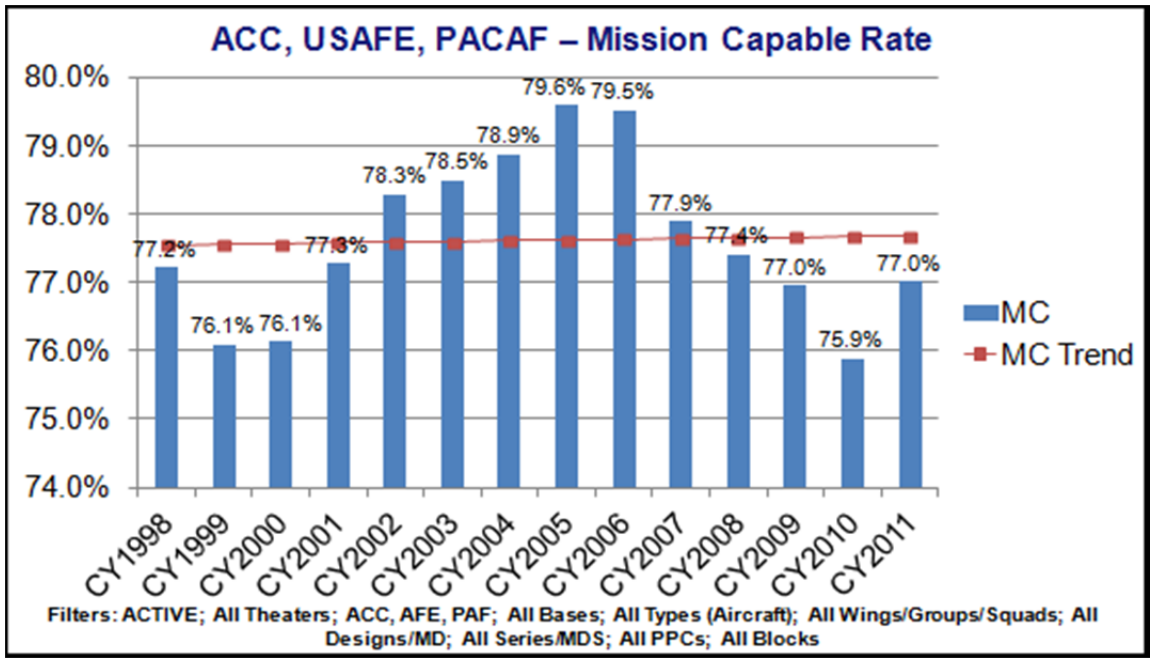


Figure 35: PACAF Not Mission Capable for Supply Rate (CY 2003 – 2012)



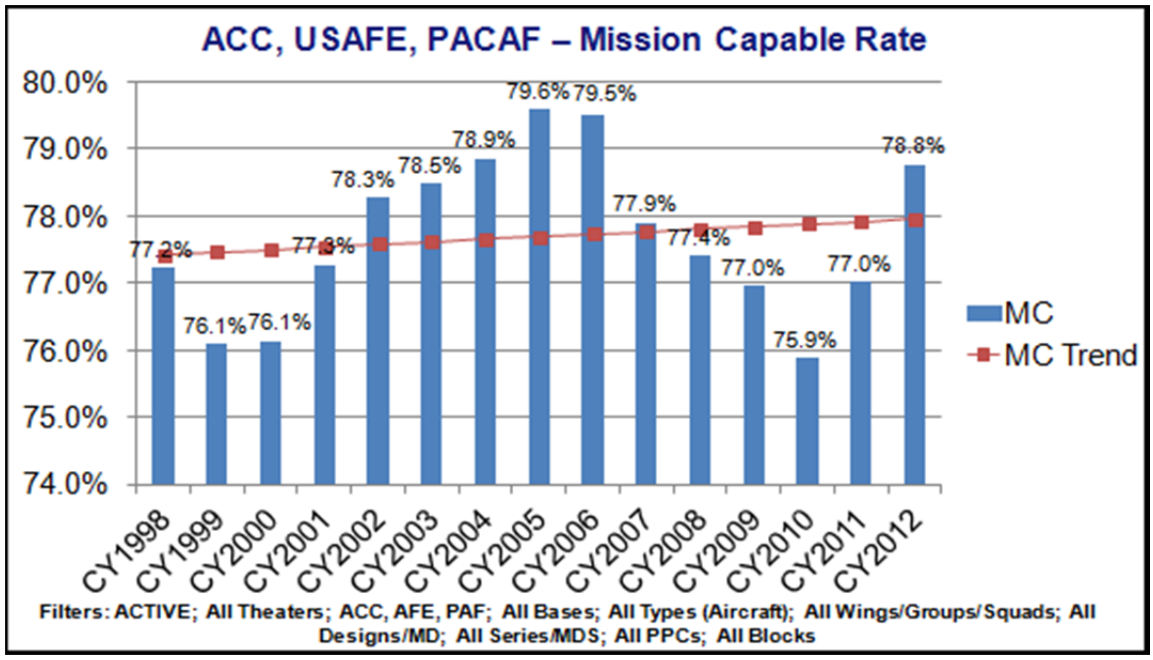
The NMCS rate is one way the LRS can affect MC rates. This connection is not a direct connection and the LRS's impact on MC rate is a minor connection. However, the LRS has some impact on MC rate and it is worth examining the NMCS rate. The catalyst for the CLR and the implementation of the LRS was the reduction of the MC rate from 84 percent in 1994 to an Air Force mean of 71 percent by 1999 (Lewis, 2009:12). According to the LIMS-EV data collected for ACC, USAFE, and PACAF, combined, the MC rate in 1999 was 78 percent, one of its lowest rates between 1998 and 2011. Notably, the MC rate went up consistently until the creation of the LRS in 2003 when it went back to 78 percent as shown in Figure 36. It remained at 78 percent in 2011. The overall trend for all three major commands is a neutral trend.

Figure 36: ACC, USAFE, PACAF Combined Mission Capable Rate (CY 1998 – 2011)



Adding the data for 2012, shown in Figure 37, illustrates a rebound in the MC rate.

Figure 37: ACC, USAFE, PACAF Combined Mission Capable Rate (CY 1998 – 2012)



Analyzing the trend before and after the implementation of the LRS there is a positive trend before and a negative trend after the implementation of the LRS shown in Figures 38 and 39.

Figure 38: ACC, USAFE, PACAF Combined Mission Capable Rate (CY 1998 – 2002)

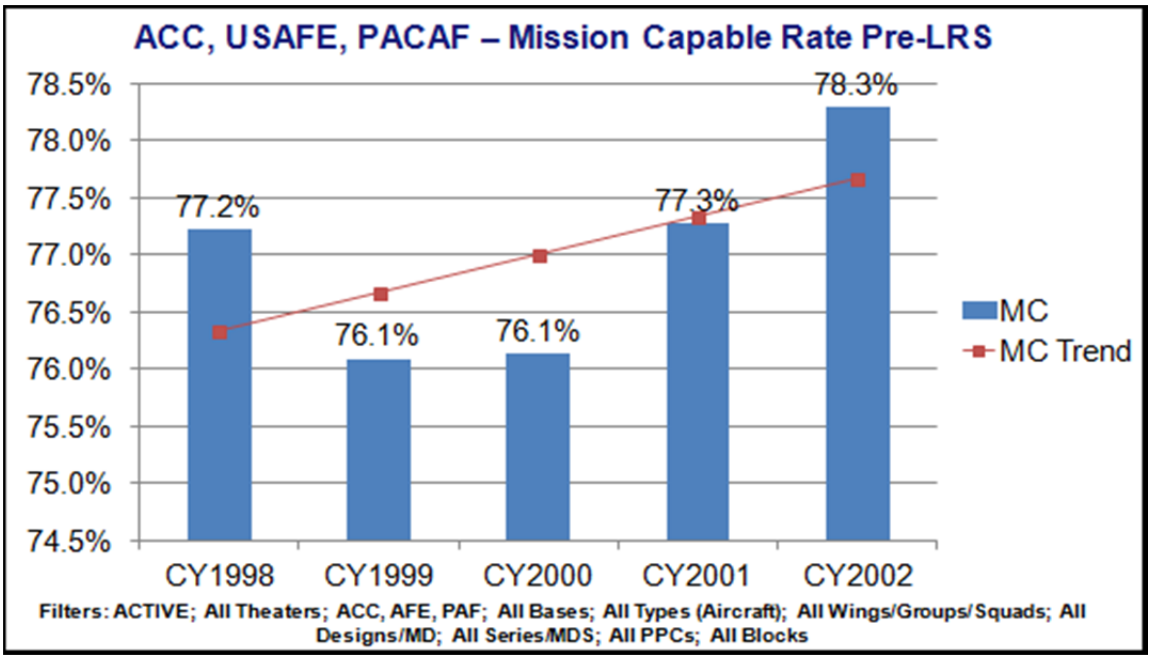
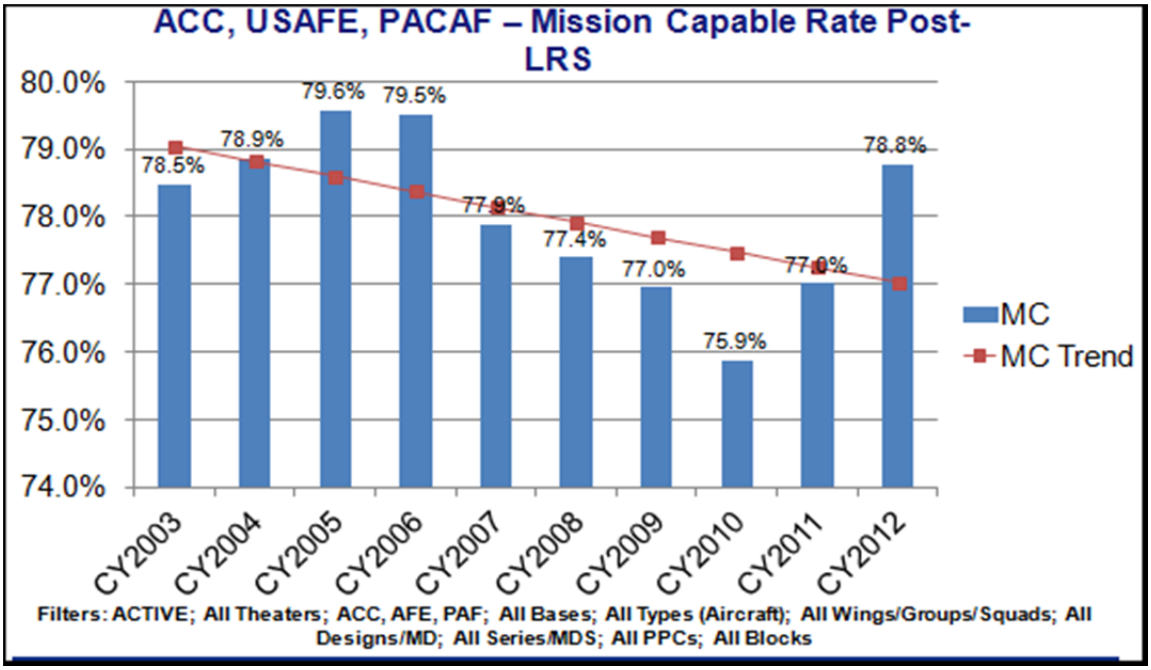


Figure 39: ACC, AMC, USAFE, PACAF Combined Mission Capable Rate (CY 2003 – 2011)



The MC rate for ACC, Figure 40, has a positive trend. The same is true for ACC's mission capable rate before the LRS implementation, shown in Figure 41.

Figure 40: ACC Mission Capable Rate (CY 1998 – 2012)

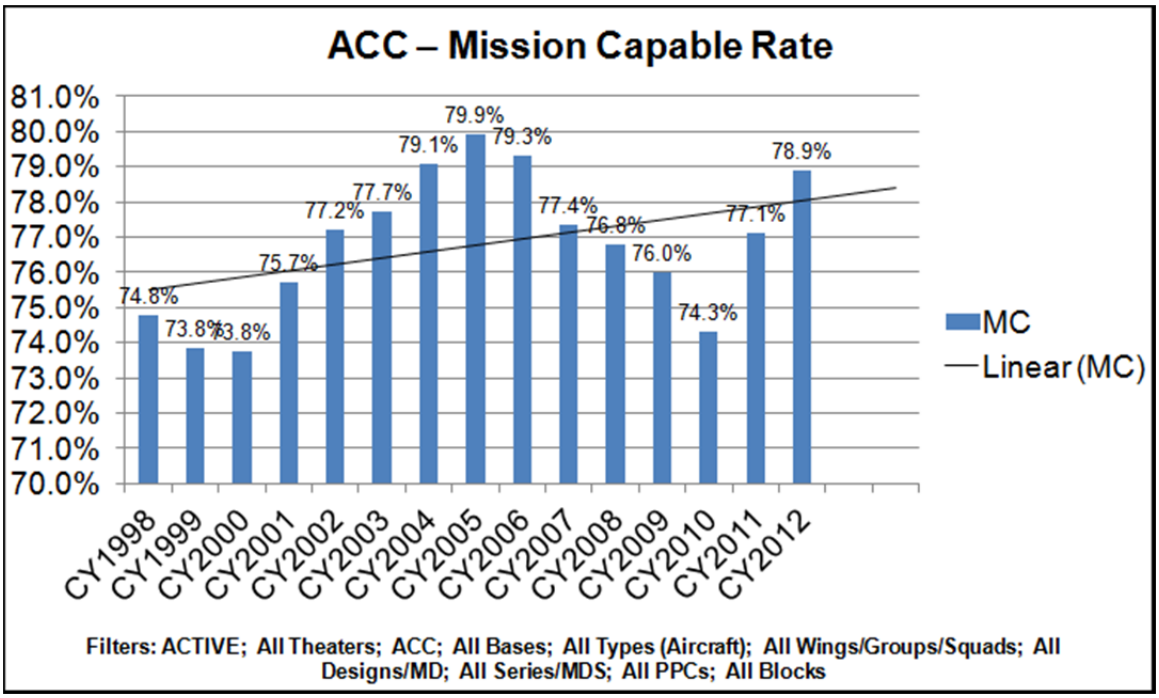
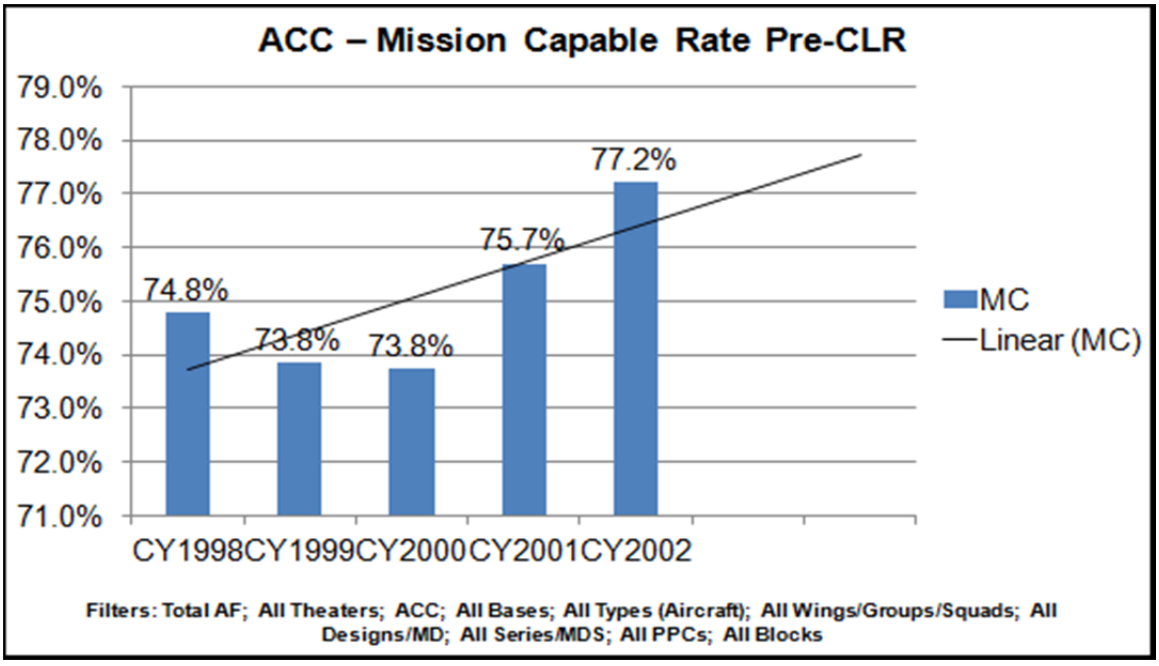
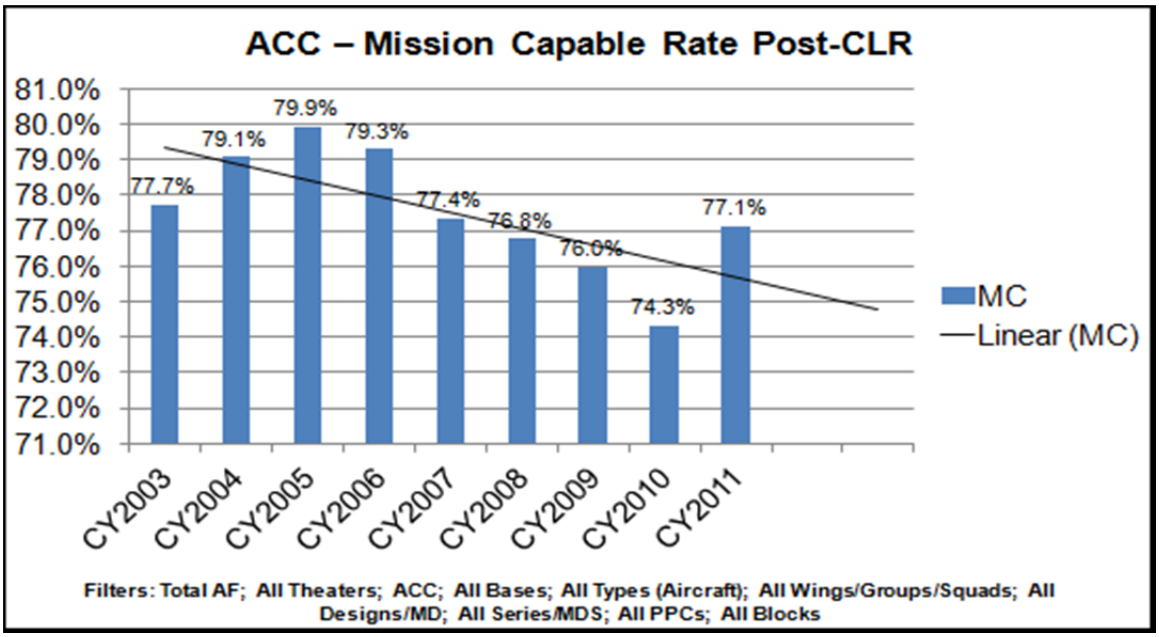


Figure 41: ACC Mission Capable Rate (CY 1998 – 2002)



However ACC's trend after the implementation of the LRS has a negative trend, as shown in Figure 42.

Figure 42: ACC Mission Capable Rate (CY 2003 – 2011)



All USAFE's trends rates both before and after the implementation of the LRS and combined show a negative trend, shown in Figures 43, 44, and 45.

Figure 43: USAFE Mission Capable Rate (CY 1998 – 2012)

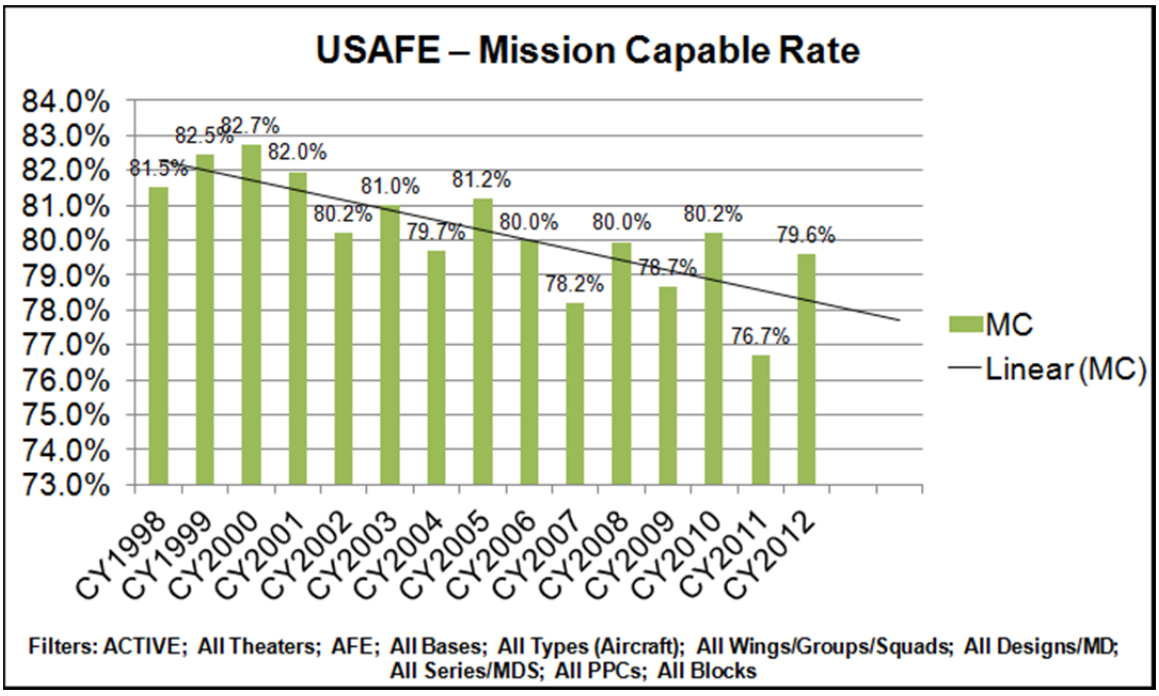


Figure 44: USAFE Mission Capable Rate (CY 1998 – 2002)

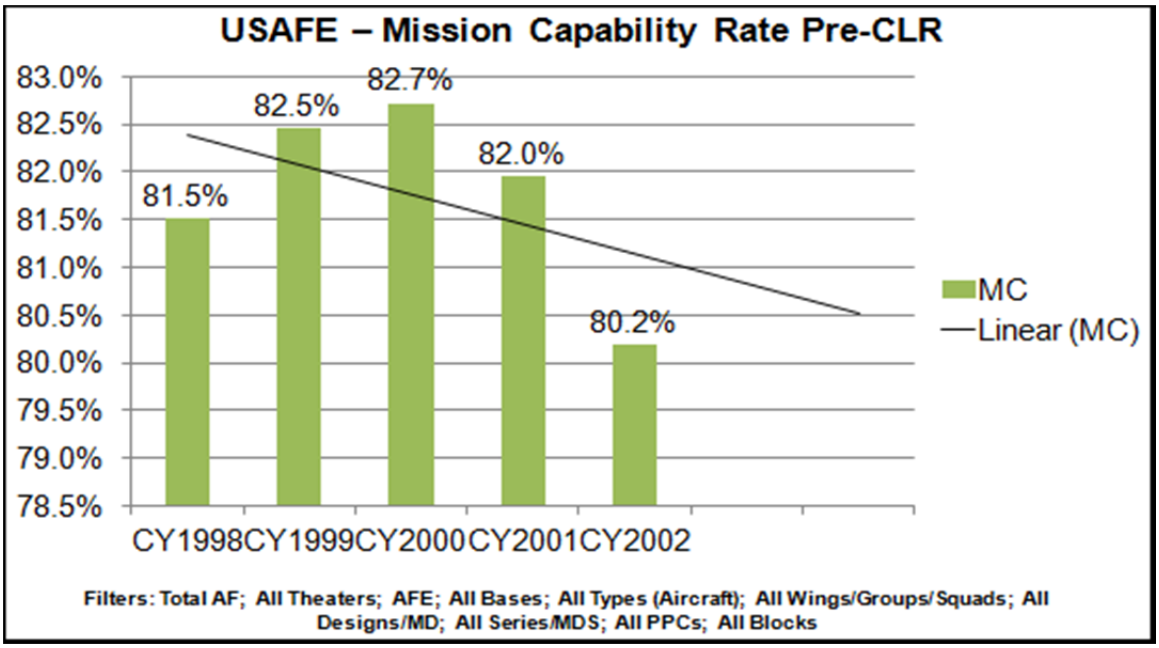
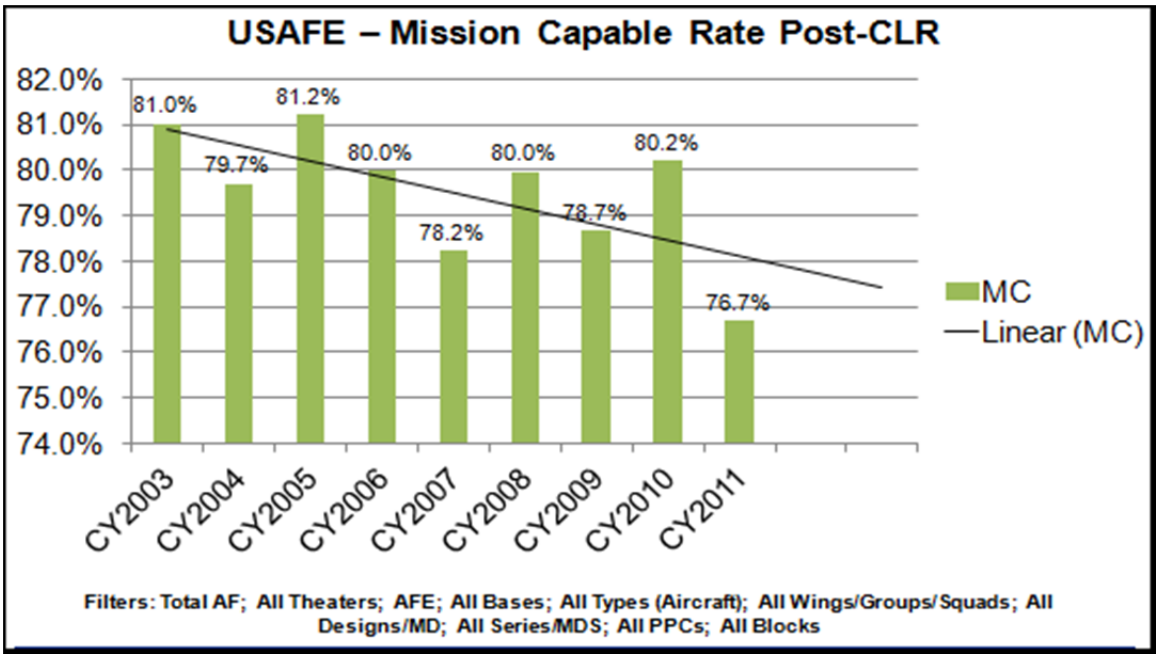


Figure 45: USAFE Mission Capable Rate (CY 2003 – 2011)



As well PACAF's trend both before and after the implementation of the LRS as well as combined show a negative trend, shown in Figures 46, 47, and 48.

Figure 46: PACAF Mission Capable Rate (CY 1998 – 2012)

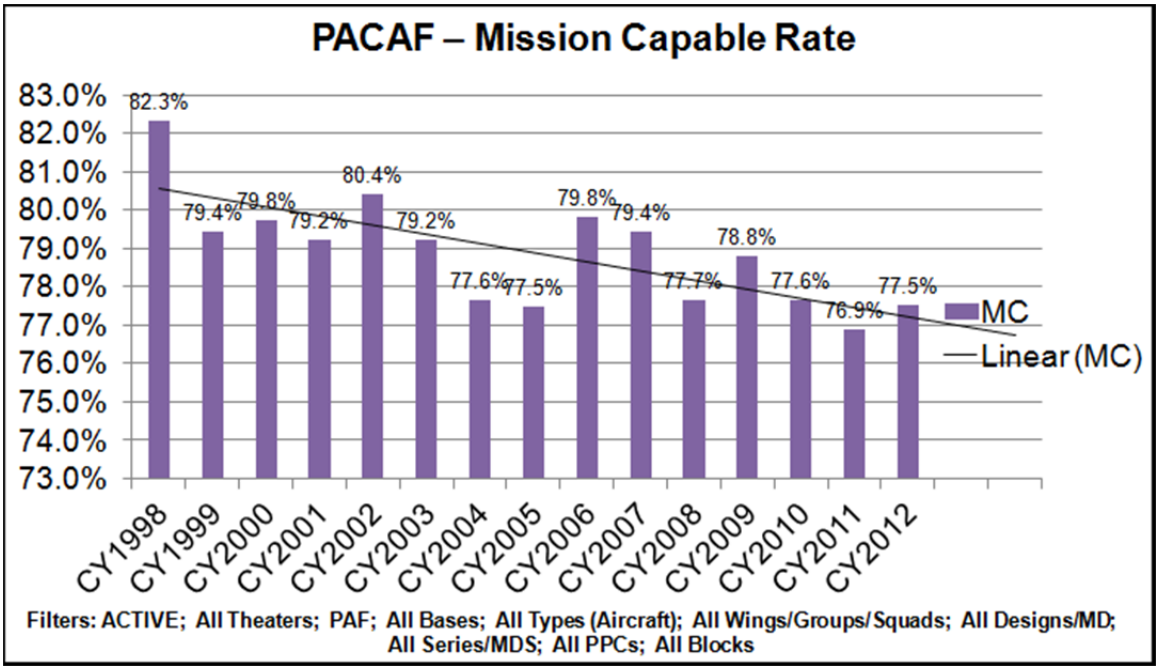


Figure 47: PACAF Mission Capable Rate (CY 1998 – 2002)

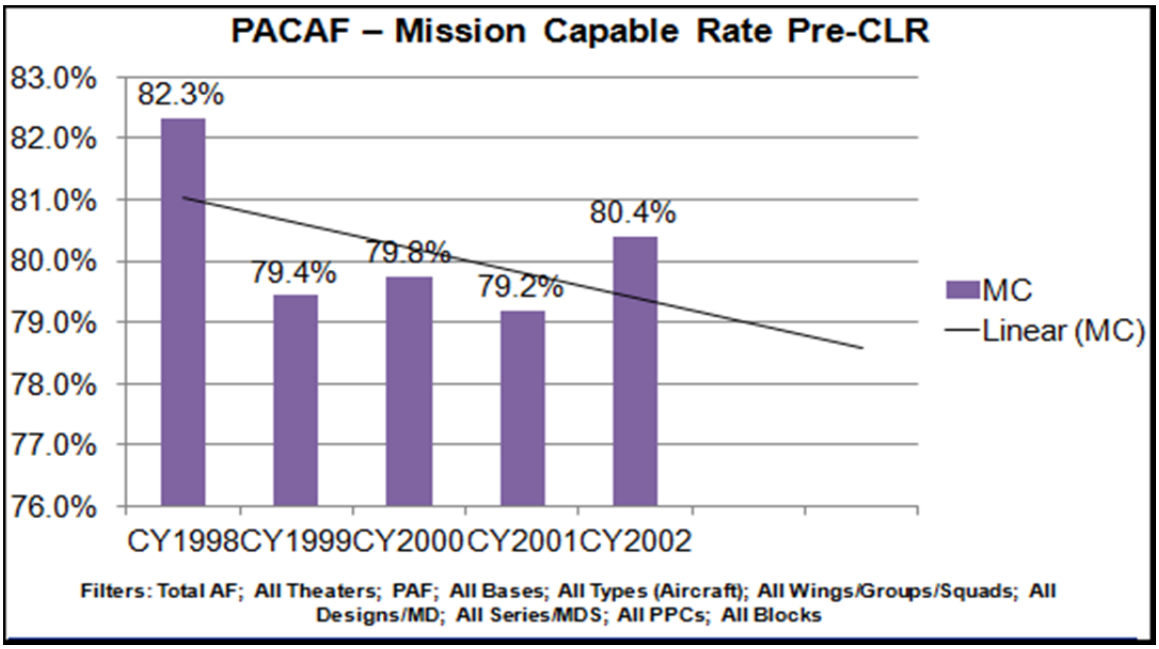
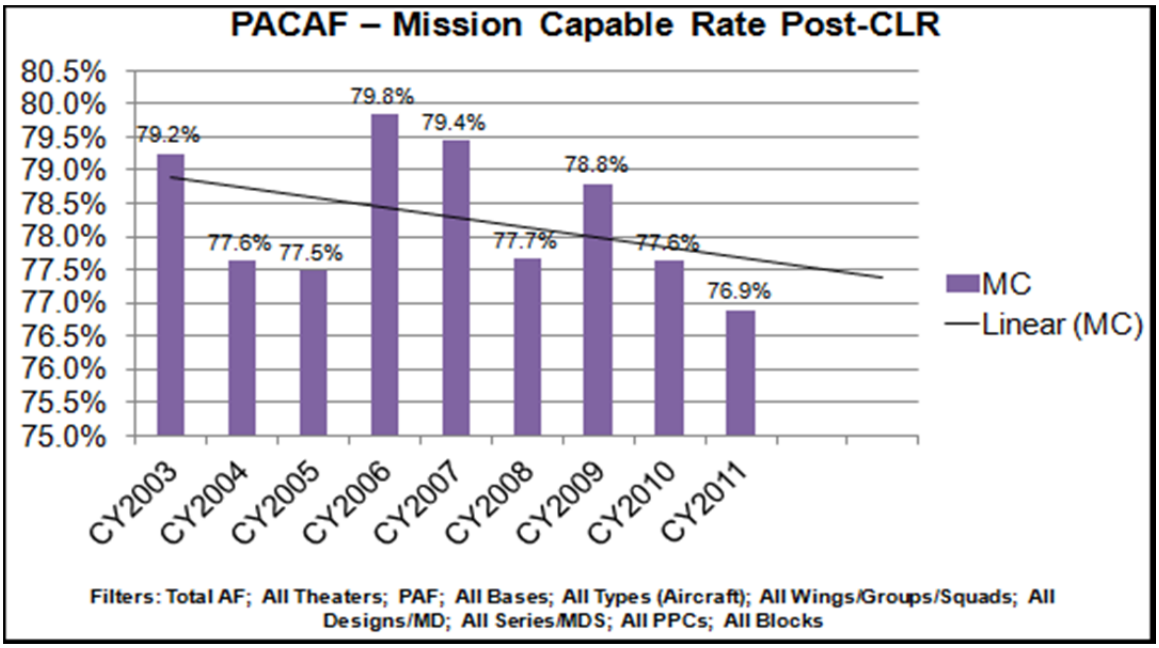


Figure 48: PACAF Mission Capable Rate (CY 2003 – 2011)



Summary

The MC rate trend for each major command and all four commands combined is outlined in Table 8. ACC shows an overall positive trend while USAFE and PACAF show a negative trend in MC rate. While trends may be negative, it should be noted that no one year average in the years studied (1998 – 2012) have hit the low of 71% as demonstrated in 1994.

Table 8: MC Rate Trend

Trend Area	ACC	USAFE	PACAF	Combined
MC Rate Pre-LRS	↑	↓	↓	↑
MC Rate Post-LRS	↓	↓	↓	↓
Overall MC	↑	↓	↓	↑

Table 9: NMCS Rate Trends

Trend Area	ACC	USAFE	PACAF	Combined
NMCS Rate Pre-LRS	↓	↑	↓	↓
NMCS Rate Post-LRS	↔	↑	↓	↔
Overall NMCS	↓	↓	↓	↓

While comparing NMCS rate trends to MC rate trends, there is an overall positive trend to NMCS rates. Notably, the overall positive trend in ACC is replicated. The only negative trend noted in NMCS rates is by USAFE both before and after the implementation of the LRS. However there is still an overall positive trend for USAFE. This same negative trend is reflected in the MC rate for USAFE. Therefore, while not a

direct comparison, the NMCS rates seem to reflect a partial impact in MC rates. All the resulting trends in NMCS rates are outlined in Table 9. It should be noted that many factors influence MC rate, to include Not Mission Capable for Maintenance, age of the aircraft, etc.

Table 10 outlines the resulting trend in inspection rates for each major command. Across the board there is a negative trend in almost all inspection results. However, the rate of the trend is very slight, as outlined in Table 6. The highest overall per year rate was -0.027 for PACAF. Based on Table 4, UCI Rating Quantitative Value one inspection rating increase is valued at 0.5. For example, to move from excellent (2.5) to outstanding (3) there must be a mean increase of 0.5. A decrease of -0.027, for the worst trend rate (PACAF), would take approximately 20 years for the overall trend to decrease the inspection result mean an entire rating. Therefore, while there is an overall negative trend, it is slight and could rebound quickly within a short period of time.

Table 10: Inspection Rate Trends

Trend Area	ACC	USAFE	PACAF	Combined
UCI Rate Pre-LRS	↑	↓	↑	↓
UCI Rate Post-LRS	↓	↓	↓	↓
Overall UCI	↓	↓	↓	↓

V. Conclusions and Recommendations

Chapter Overview

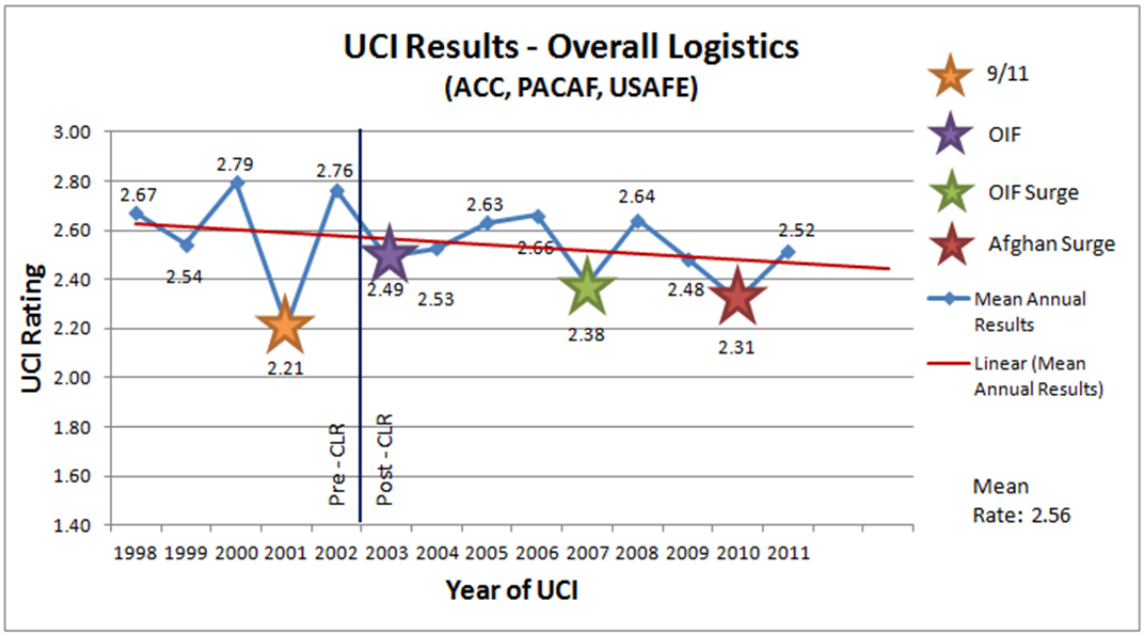
This chapter will discuss the overall conclusions, recommendations for action, and recommendations for future research. The conclusion and recommendations will be based on how the data and analysis of the data answered the research questions. The data and analysis of this research do not encompass all factors that have an effect on the LRS or the impact it may have on the aircraft availability rates for the Air Force. The conclusions in the paper focus only on the data collected.

Conclusions of Research

This research will not determine the solution for any shortcomings it may discover. As shortcomings are identified solutions will be presented; however, the research may or may not support the proposed solutions. It is the conclusion of this research that the effectiveness of the LRS is inconclusive. The organizational structure for the Air Force's logistics processes and the LRS impact on Air Force aircraft availability rate is inconclusive. Neither UCI trends nor the NMCS data seem to indicate a specific change in trend since the implementation of the LRS. While there is an overall negative trend of UCI inspection results for each major command before and after the implementation of the LRS it is clear that the trend is very slight and could quickly change to a positive trend. There are many other factors that may have an effect on UCI ratings for the LRS. Further examining the overall UCI ratings analysis chart in Figure 1 there are four major events which may have caused the overall negative trend reflected in

each major command and the dip in ratings during the years 2001, 2003, 2007, and 2010. Figure 49 highlight these events.

Figure 49: UCI Results with Major Event in History



Each of these events, the year of the September 11th terror attacks, the year OIF began, the year of the OIF surge, and the year of the Afghanistan surge all coincided with an increase in mission workload and an increase in deployment rate for logistics officers. Both are factors that may have resulted in a reduced inspection rate. With further analysis of future inspections it may be discovered that the trend may reverse, given a reduction in the deployment commitment for the LRO. While LROs conduct Air Force logistics tasks while deployed, LROs have also performed a variety of tasks that are outside of LRO expected wartime tasks (e.g. Army logistics augmentation). This additional requirement may have also placed an additional strain on the LRO and compromised performance in the LRS. An LRO performing outside their expected core competencies means losing proficiency. Even with the reduction in the mean rating in

the years, 2001, 2004, 2007, and 2010 the negative trend for inspection ratings is minor. It can be argued that the trend would be positive given LROs deployed less.

Examining NMCS rates and their contribution to MC rates, there is no doubt they have improved since the implementation of the LRS. Assuming the NMCS rate is a direct contributor to aircraft availability, the LRS has been a positive contributor to the MC rate. While the NMCS rate does not reflect directly to the MC rate on Table 8 and Table 9, there are many other factors that affect MC rates besides NMCS rates. With exception of the USAFE NMCS trend, the NMCS rate demonstrated a positive trend both before and after the implementation of the LRS. The post-CLR data for all four major commands combined have demonstrated distinctly better NMCS percentages than the pre-CLR data. In 1999 the NMCS rate was 7.6% beginning a steady downward trend to 4.8% in 2008. Other factors contribute to the reduced NMCS percentage. For example, the creation of GLSC and the global enterprise of parts procurement and distribution may have had the largest impact on the NMCS rate. However, during the year of the GLSC's creation (2008) the NMCS rate for the three major commands was 4.8%. The NMCS rate increased for the next two consecutive years to 5.3% (2009) and 5.9% (2010) before beginning the most recent minor downward trend to 5.6% (2011). Therefore, the research indicates the LRS has a positive impact on the NMCS rate and a positive influence on aircraft availability.

Significance of Research

The conclusions presented may have significant impact on the decisions made by Air Force senior leaders with regard to the future of the LRS. The inspection data and

NMCS data examined in this paper have never been scrutinized as a direct reflection of LRS effectiveness. Therefore this research provides significant insight into the performance of the LRS since its creation in 2003. This research provides a valuable tool for critical decision making with regard to the LRS.

Recommendations for Action

It is recommended to continue this research to determine if the NMCS rate continues to show a positive trend. Additionally, it is recommended to continue the analysis of the UCI results to determine if the negative trend continues. It is possible, with a reduction in the LRO deployment rate, the UCI inspection results will trend in a positive direction.

Recommendations for Future Research

A similar analysis of Logistics Compliance Assessment Program (LCAP) inspection results and ORI results can be analyzed to identify any trends and its association with LRS value. LCAP and ORI inspection data can be compared to the research in this paper and continued UCI analysis to make future trend determinations. Together this research will provide stronger trend data for the LRS and reflect an inference on the effectiveness of the LRS. Also future research can be conducted on the Aerial Port Squadron (APS) inspection data to determine any correlations between the LRS and APS drawing some conclusions about the effectiveness of the LRO. Analysis on the LRO deployment rate combined with all LRS and APS inspection data can be linked to identify any correlations. This research can be expanded to squadron

commander deployments and the inspection results from the squadron they command to identify any direct degradation as a result of those deployments.

Summary

There are many factors that determine LRS effectiveness and have impact on aircraft availability. Based on UCI results the effectiveness of the LRS is neither positive nor negative. As determined through NMCS rate analyzed in this research the LRS is effective and has a positive impact on the NMCS rate and aircraft availability. The RAND study concluded that combining the supply and transportation functions into the LRS could improve customer support, responsiveness, and reliability while reducing process cycle time with regard to aircraft parts (Lynch, 2005:56). In comparison to the supply squadron, transportation squadron, and logistics plans section of the pre-CLR era, the LRS is a neutral evolution for Air Force logistics. Given time to mature in an era with a lower LRO deployment rates the LRS has the potential to demonstrate a positive inspection rate trend and continue its benefit for the Air Force.

Appendix A

Unit Compliance Inspection Report – 4th Fighter Wing – Oct – Nov 2000

AIR COMBAT COMMAND
OFFICE OF THE INSPECTOR GENERAL

UNIT COMPLIANCE INSPECTION REPORT

4TH FIGHTER WING
1510 WRIGHT AVENUE
SEYMOUR JOHNSON AFB NC 27531-2468

30 OCTOBER – 3 NOVEMBER 2000

"GLOBAL POWER FOR AMERICA"

Appendix B

Unit Compliance Inspection Report – 65th Air Base Wing – Sep 2008

FOR OFFICIAL USE ONLY

UNITED STATES AIR FORCES IN EUROPE
INSPECTOR GENERAL

65TH AIR BASE WING
UNIT COMPLIANCE INSPECTION

LAJES FIELD, AZORES PORTUGAL
7 – 15 SEPTEMBER 2008

THIS IS A PRIVILEGED DOCUMENT THAT CANNOT BE RELEASED IN WHOLE OR PART TO PERSONS OR AGENCIES OUTSIDE THE AIR FORCE, NOR CAN IT BE REPUBLISHED IN WHOLE OR PART IN ANY PUBLICATION NOT CONTAINING THIS STATEMENT, INCLUDING AIR FORCE MAGAZINES AND GENERAL USE PAMPHLETS, WITHOUT THE EXPRESS APPROVAL OF THE SECRETARY OF THE AIR FORCE.

PUBLISHED: 15 OCTOBER 2008

FOR OFFICIAL USE ONLY

Appendix C

Quad Chart - An Empirical Investigation of the Effectiveness of the Logistics Readiness Squadron Concept

An Empirical Investigation of the Effectiveness of the Logistics Readiness Squadron Concept

Maj Christopher L. Carmichael
Advisor: Doral E Sandlin, Lt Col, Ph.D., USAF
Sponsor: Christopher D. Holmes, Lt Col, USAF
Advanced Study of Air Mobility (ASAM)
Air Force Institute of Technology

Introduction

The research in this paper attempts to determine the effectiveness of the Logistics Readiness Squadron (LRS). It examines Unit Compliance Inspections (UCI) results and Not Mission Capable for Supply (NMCS) rates gathered from 1998 till 2011. This data will help to determine any positive or negative trends as a result of the LRS concept.

Research Goals

- Identify any trend with Supply Squadron, Transportation Squadron, and Logistics Plans section inspection results compared with LRS inspection results
- Identify any trend with separate logistics functions (supply, trans, log plans) inspection results before and after the implementation of the LRS
- Identify any trend with the NMCS rates before and after the implementation of the LRS

AIR FORCE INSTITUTE OF TECHNOLOGY

General Framework

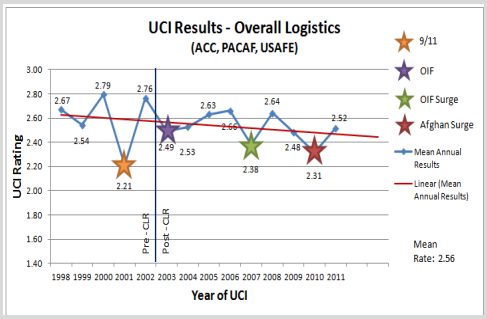


Table 10: Inspection Rate Trends

Trend Area	ACC	USAFE	PACAF	Combined
UCI Rate Pre-LRS	↑	↓	↑	↓
UCI Rate Post-LRS	↓	↓	↓	↓
Overall UCI	↓	↓	↓	↓

Table 9: NMCS Rate Trends

Trend Area	ACC	USAFE	PACAF	Combined
NMCS Rate Pre-LRS	↓	↑	↓	↓
NMSC Rate Post-LRS	↔	↑	↓	↔
Overall NMCS	↓	↓	↓	↓

Application

This research provides critical trend analysis of LRS inspection data and NMCS data providing Air Force logistics leaders data points for future COAs regarding the LRS.

Motivation

Eight years after the implementation of the LRS no quantitative trend analysis has examined its effectiveness. Now is the time to examine if the creation of the LRS was the correct decision for the Air Force's logistics enterprise.

Impacts/Contributions

The research concludes a the LRS has a neutral effect with regard to inspection results and a positive effect with regard to NMCS rates. Other factors are not analyzed in the data, such as LRO deployment rate. This research provides a valuable tool for critical decision making with regard to the LRS.

Collaboration: HAF A4/A4LF

Bibliography

Chimka, Justin R. and Nachtmann, Heather. "Operational Readiness as a Function of Maintenance Personnel Skill Level," Inside Logistics, Volume XXI, Number 3: 45-51.

Department of the Air Force. *Secretary of the Air Force*. Air Force Policy Directive 90-2 Inspector General – The Inspection System. Washington: HQ USAF, 26 April 2006.

Dyess, Anthony T., *Multifunctional Logistics: Comparing Air Force and Army Constructs, Monograph AY 02-03.* School of Advanced Military Studies United States Army Command and General Staff College, Fort Leavenworth, KS, April 2003.

HQ PACAF A4. "LRO/LRS in Crisis." Electronic Message. April 2010.

Lewis, Keith A. *A Study on the Air Force's Ability to Field Senior Logistics Readiness Officers Experienced in Fuels Management*, MS Thesis AFIT/GLM/ENS/05-14. Department of Operational Sciences Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB, OH, March 2005.

Lewis, Ted A. *The Logistics Readiness Squadrons and Logistics Readiness Officer Development and Composition: Stop the Continuous Change—We've Got it Right,* Air University, Maxwell AFB, AL. February 2009.

LIMS-EV, Logistics Installations and Mission Support – Enterprise View. Version 1.0, SAP Business Objects, https://www.my.af.mil/afksprod/InfoViewApp/listing/main.do?appKind=InfoView&service=%2FInfoViewApp%2Fcommon%2FappService.do. Website. Lockheed Martin, Endicott, NY, 2010.

Lynch, Kristin F., et al. "The Air Force Chief of Staff Logistics Review, Improving Wing-Level Logistics." RAND Report MG-190 (2005).

Pendley, Scotty A. et al, "Establishing C-5 TNMCM Standards," *Air Force Journal of Logistics*, Vol XXXII, Number 2 (2008)

Thompson, James . D., 1967. *Organizations in Action*. New York: McGraw-Hill.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
15 Jun 1012	Master's Thesis	20 May 2011 – 15 Jun 2012

4. TITLE AND SUBTITLE
An Empirical Investigation of the Effectiveness of the Logistics Readiness Squadron Concept

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Carmichael, Christopher L., Maj, USAF

5d. PROJECT NUMBER
If sponsor, write JON# here, or N/A if no $$.

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/ENV)
2950 Hobson Way, Building 640
WPAFB OH 45433-8865

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/IMO/ENS/12-04

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Holmes, Christopher D., Lt Col, USAF, HAF Acting Chief, Force Development and Organizations Division, HAF A4/A4LF
Pentagon, VA 20330
(703) 697-7335, christopher.holmes@pentagon.af.mil

10. SPONSOR/MONITOR'S ACRONYM(S)
A4/A4LF

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Distribution Statement A: Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The research in this paper attempts to determine the effectiveness of the Logistics Readiness Squadron (LRS) and its effect on Air Force aircraft availability. It examines Unit Compliance Inspections (UCI) results and Not Mission Capable for Supply (NMCS) rates gathered from 1998 till 2011. The data generates a trend before and after the implementation of the LRS. The results are analyzed to determine the positive, negative, or neutral trend. There are many factors that determine LRS effectiveness and have impact on aircraft availability. Based on the analysis of the UCI data the effectiveness of the LRS is neutral. Based on NMCS data the LRS is effective. In comparison to the supply squadron, transportation squadron, and logistics plans section of the pre Chief-of-Staff Logistics Review (CLR) era, the LRS is neither a positive nor a negative evolution for Air Force logistics. Given time to mature in an era with a lower LRO deployment rates the LRS has the potential to demonstrate a positive inspection rate trend and continue to benefit the Air Force.

15. SUBJECT TERMS
4-5 Keywords/phrases

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Sandlin, Doral E., Lt Col, Ph.D, USAF
U	U	U	UU or SAR	85	19b. TELEPHONE NUMBER *(Include area code)* (937) 255-3636, x 4740 (doral.sandlin@afit.edu)